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**Special Crash Investigations:
Alleged Steering Malfunction Crash
Investigation;
Vehicle: 2015 Chevrolet Silverado;
Location: Florida;
Crash Date: November 2018**

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16. Abstract This report documents the investigation of a single-vehicle crash involving a 2015 Chevrolet Silverado alleged to have had a potential safety-recall-related steering malfunction. The crash occurred during the afternoon hours in November 2018 in Florida. The Chevrolet was being driven by a belted 68-year-old male. The vehicle departed the roadway on the right edge, struck several off-road objects including trees and a utility pole support cable, then overturned onto its left plane, where it came to rest partially on the roadway. According to the police report, the driver suffered a medical episode. He was transported by an ambulance to a local hospital, where efforts to resuscitate him were unsuccessful, and he was pronounced deceased. His autopsy report revealed a history of heart disease, diabetes, and a pacemaker. The findings included the presence of cardiomegaly with coronary atherosclerosis, cerebral atherosclerosis, and cirrhosis of the liver with ascites. He sustained a minor laceration to the left arm during the crash. The cause of death was determined to be atherosclerotic cardiovascular disease; a contributory condition was diabetes mellitus, and the manner of death was natural. The investigation did not reveal any evidence that a steering system malfunction occurred either prior to or during this crash.			
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**Special Crash Investigations
Alleged Steering Malfunction Crash Investigation
Office of Defects Investigation
Case Number: DS19035
Vehicle: 2015 Chevrolet Silverado
Location: Florida
Crash Date: November 2018**

BACKGROUND

This report documents the investigation of a single-vehicle crash involving a 2015 Chevrolet Silverado (**Figure 1**) alleged to have had a potential safety-recall-related steering malfunction. The investigation was initiated by the Special Crash Investigations (SCI) group of the National Highway Traffic Safety Administration in response to a notification received by the Office of Defects Investigations (ODI) in November 2018 alleging that the crash was attributable to a recent recall. The investigation was intended to assess the vehicle's steering and braking system's functionality at the time of the crash, assess the vehicle's recall history, and determine what role, if any, potential malfunctions may have played in the crash. The investigation did not reveal any evidence that a steering system malfunction occurred either prior to or during this crash.



A safety recall search revealed that the Chevrolet was subject to one unrepaired recall issued 10 months after the crash, the nature of which could potentially decrease the amount of vacuum to the power brake assist system. One closed recall was identified, involving an electric power steering (EPS) loss of steering assist, in which the vehicle may experience a temporary loss of EPS assist followed by a sudden return of EPS assist, particularly during low-speed turning maneuvers. This recall was issued in September 2018, and the owner received a recall notice dated October 2018. Six days prior to the crash date in November 2018, OEM service was completed on the vehicle that included power steering control module reprogramming with service programming system (SPS). In November 2018, NHTSA requested that the SCI team obtain the police report and the Event Data Recorder (EDR). The police were contacted and indicated that they did not image the EDR. The police report and autopsy reports were obtained in February 2019. On-scene images were requested and obtained in May 2019.

The case was assigned to Dynamic Science in October 2019, and field inspections were completed in November 2019. In attendance for the vehicle inspection were three representatives from the manufacturer, General Motors (GM), and a legal representative for GM. GM provided SCI with Diagnostic Trouble Code (DTC) data collected during the vehicle inspection, a service history report, and an OEM build sheet. The DTC display indicated that no DTCs were present for either the power steering control module or the electronic brake control module. The

vehicle's steering and braking systems were visually inspected and, given the vehicle's post-impact damage that included restriction of the right front wheel, appeared to function normally. The Chevrolet's EDR was supported by the Bosch Crash Data Retrieval (CDR) system and was imaged during the vehicle inspection. The EDR report revealed no braking occurred prior to the crash. The report did not include steering input data. The complete EDR report is included in this report as **Appendix A**.

The crash occurred during the afternoon hours in November 2018 in Florida. The crash site was a straight and level three-lane undivided roadway located in a mixed-use urban area (**Figure 2**). Conditions were daylight, clear, and dry. The Chevrolet was being driven southbound by a belted 68-year-old male. The vehicle departed the roadway on the right edge, struck several off-road objects including trees and a utility pole support cable, then overturned onto its left plane, where it came to rest partially on the roadway. According to the police report, the driver reportedly suffered a medical episode. He was transported by an ambulance to a local hospital, where efforts to resuscitate were unsuccessful, and he was pronounced deceased. His autopsy report revealed a history of heart disease, diabetes, and a pacemaker. The findings included the presence of cardiomegaly¹ with coronary atherosclerosis, cerebral atherosclerosis, and cirrhosis of the liver with ascites.² He sustained a minor laceration to the left arm during the crash. The cause of death was determined to be atherosclerotic cardiovascular disease. A contributory condition was diabetes mellitus and the manner of death was natural. The Chevrolet was towed due to disabling damage and placed on an attorney hold.



Figure 2. Crash site, looking south.

SUMMARY

Crash Site

The crash site was a straight and level three-lane undivided roadway located in a mixed-use urban area. The north/south roadway was paved with asphalt and configured with one lane for each direction. The center section of roadway included intermittent sections of turn lanes and painted medians configured with double yellow painted stripes. The lanes measured 3.8 m (12.5 ft) wide and were bordered by solid white painted fog lines, bike lanes measuring 1.5 m (5.0 ft) wide and raised concrete curbs measuring 13 cm (5.0 in) high. In the area of impact, the roadside west of the southbound lane included a paved sidewalk, driveway, mature trees planted intermittently at approximately 6.0 m (20.0 ft) apart, a utility meter, and a wood utility pole configured with steel support cables. The crash sequence began in the intersection at the north end of a block and ended at the intersection at the south end. There were no traffic control devices for southbound traffic in this area. Points of impact and evidence of damaged off-road objects were documented during the scene inspection on the curb, three trees, one shrub, one

¹ Cardiomegaly: abnormal enlargement of the heart.

² Ascites: accumulation of fluid in the peritoneal cavity causing abnormal swelling.

utility meter, and two steel cables supporting a utility pole. Police on-scene images were used to identify points of impact for objects that had been replaced following the crash including a tree, a shrub, and a utility meter. The posted speed limit was 56 km/h (35 mph). Conditions at the time of the crash were daylight, clear, and dry. A crash diagram is included at the end of this report.

Pre-Crash

The Chevrolet was being driven southbound by the seat-belted 68-year-old male at an EDR reported vehicle speed of 60 km/h (37 mph) at T-5.0 seconds prior to algorithm enable (AE). According to a witness traveling behind the Chevrolet at approximately the same speed, the Chevrolet appeared to turn to the right prior to striking the curb at approximately T-1.0 seconds. The Chevrolet driver continued to apply accelerator pressure and, after departing the roadway, the vehicle traveled southbound in a relatively straight path parallel to the roadway. The EDR report indicated the brake switch circuit was not activated at any time during the pre-crash sequences captured in three event records, supporting the police-reported theory that the driver may have experienced a medical episode, and was later supported by evidence in the autopsy findings. The Chevrolet’s pre-crash speed and distance calculations derived from EDR data are included in the following table:³

Time -sec	Vehicle Speed		Distance Traveled			
	km/h	mph	Incremental		Cumulative	
			m	ft	m	ft
5	60	37	NA	NA	NA	NA
4.5	63	39	8.5	27.9	8.5	27.9
4	64	40	8.8	29	17.3	56.9
3.5	66	41	9.1	29.7	26.4	86.6
3	68	42	9.3	30.4	35.7	117
2.5	68	42	9.4	30.8	45	147.8
2	68	42	9.4	30.8	54.4	178.6
1.5	64	40	9.2	30.1	63.6	208.7
1	64	40	8.9	29.3	72.5	238
0.5	56	35	8.4	27.5	80.9	265.5
0	43	27	6.9	22.7	87.8	288.2

Crash

Following the curb impact (Event 1), the Chevrolet continued traveling off-road in a southbound trajectory while sustaining a total of seven impacts and a rollover event for a total of eight events. Event 2 was a deployment event in which the vehicle’s front plane struck a mature palm tree causing deployment of the driver’s frontal air bag and actuation of his seat belt pretensioner. It was possible the impact with the tree caused damage to the vehicle’s right plane, restricting movement of the right front wheel. While this damage may have affected the vehicle’s steering functionality, the absence of braking input suggests the driver was not attempting avoidance maneuvers during the crash sequence. The vehicle then struck a utility meter with its front plane (Event 3), two small-diameter trees (Events 4 and 5), a shrub (Event 6), and two steel cables

³ The curb impact event and roadway departure, not captured by the EDR, occurred at approximately T-1.0 seconds.

supporting a utility pole (Event 7) that caused the Chevrolet to initiate a flip-over type rollover. The rollover was a deployment event in which the vehicle's left and right IC air bags deployed as it overturned, left-side-leading, one quarter-turn along its longitudinal axis, returned partially to the roadway, and came to rest facing south on its left plane (Event 8). Estimated rollover distance was 8 m (26 ft).

Overlapping damage caused by seven frontal impacts could not be separated precluding a WinSMASH reconstruction. A barrier algorithm of the WinSMASH program was run for informational purposes and calculated a total delta V of 16 km/h (10 mph), longitudinal delta V of -16 km/h (-10 mph), lateral delta V of 0 km/h and barrier equivalent Speed (BES) of 16 km/h (10 mph). The EDR captured this deployment event and reported a maximum longitudinal delta V of -22 km/h (-14 mph) and a maximum lateral delta V of 1 km/h (1 mph). Using EDR-reported vehicle speed and time between events, it was determined the EDR deployment event corresponded to crash Event 2 involving a front-plane impact with a tree.

Post-Crash

The Chevrolet came to rest on its left plane (**Figure 3**) and the driver was unresponsive. Emergency responders removed the windshield and backlight to extricate the driver from the vehicle. He was transported by an ambulance to a local hospital, where resuscitation efforts were unsuccessful, and the driver was declared deceased in the ER. The Chevrolet was towed due to damage and placed on an attorney hold.



Figure 3. The 2015 Chevrolet Silverado at final rest, looking north (police photo).

2015 CHEVROLET SILVERADO

Description

The 2015 Chevrolet Silverado was identified by the Vehicle Identification Number 3GCPCREC6FGxxxxxx. The Chevrolet was a 4-door, rear-wheel-drive, full-size light truck configured with a crew cab, short cargo box, 8-cylinder, 5.3-liter, gasoline engine, hydraulic brakes, and all-wheel ABS disc brakes. The odometer reading at the time of the inspection was 72,712 km (45,181 mi). This vehicle was purchased new approximately 3 years and 11 months prior to the crash by the driver, who was the original owner. A vehicle history report indicated that no prior collisions were reported. The vehicle manufacturer's recommended tire size was P265/65R18 for the front and rear with a cold pressure of 241 kPa (35 psi). It was equipped with Goodyear Wrangler SR-A tires of the recommended size manufactured in 2014. The vehicle was configured with seating for five in two rows. The front row was equipped with bucket seats and adjustable head restraints. The driver's seat track setting was unknown. The cargo bed was equipped with an aftermarket fiberglass tonneau cover manufactured by A.R.E. Accessories LLC, Massillon, Ohio.

Exterior Damage

The Chevrolet sustained direct or induced damage to the front plane including bumper grille and fascia, the right-front fender, right front-row door, right-rear fender, rear bumper, left-rear fender, left second-row door, left front-row door, left-front fender, left roof-side rail, and hood.

The vehicle sustained minor front-plane damage caused by frontal impacts with two trees, a large shrub, a utility meter, and steel cables. The vehicle sustained sheet metal crush damage to the right plane caused by undetermined frontal impacts. Crush damage to the left plane and induced damage to the back plane were caused during the rollover. The right-front tire was restricted, and both rear view mirrors were displaced from the body.

Direct damage to the front plane began at the centerline of the front bumper and extended 90 cm (35.4 in) to the right ending at the front right bumper corner (**Figure 4**). The field L extended from bumper corner to bumper corner. Vertically, the damage extended from the frame level to the beltline. Overlapping damage caused by five frontal impacts could not be fully separated⁴ and a single set of twenty-three measurements were taken at bumper level by the Nikon Total Station. The Faro Blitz program computed crush measurement in six increments as follows: $C_1 = 0$ cm, $C_2 = 0$ cm, $C_3 = 4$ cm (1.6 in), $C_4 = 15$ cm (5.9 in), $C_5 = 0$ cm, and $C_6 = 15$ cm (5.9 in). Maximum crush was located 34 cm (13.4 in) right of the longitudinal centerline. The Collision Deformation Classification (CDC) for the Chevrolet in Event 2 was 12FZEW1.



Figure 4. Front-plane damage, the 2015 Chevrolet Silverado.

Events 1, 4, 5, 6, and 7 were frontal impacts causing overlapping damage to the front plane which could not be separated.

Direct damage and the field L to the left plane began at the left front corner and extend rearward to the left rear corner. The one quarter-turn rollover did not result in any vertical crush. Maximum lateral crush was located on the left roof side rail at 32 cm (12.6 in) forward of the left B-pillar and measured 2 cm (0.8 in). The CDC for the Chevrolet in Event 8 was 00LDAO3.

Alleged Steering Malfunction Discussion

A notification sent to NHTSA and received in November 2018 reported the crash and attributed the subsequent driver's fatal injuries to a safety recall applicable to the 2015 Chevrolet Silverado. Product Safety Recall 18289 Loss of Steering Assist (NHTSA Recall No. 18V-586) was released in September 2018, approximately two months prior to the crash. The OEM had determined that a defect relating to motor vehicle safety existed in certain 2015 model year Chevrolet Silverados, as well as other model vehicles. Recall documents indicated that the vehicles may experience a temporary loss of EPS assist followed by a sudden return of EPS assist, particularly during low-speed turning maneuvers. The loss and sudden return of EPS assist typically happened in a 1-second period and was caused by an electrical/software issue. To correct the issue, OEM dealers would perform a reflash of the EPS module software. No parts were required for the procedure.

⁴ Damage caused in Event 2 was located at front right bumper corner, damage caused in Event 3 was located beginning center bumper extending into right one-third sector.

The Service Procedure notes included the instruction: “Clear DTCs after programming is complete. Clearing powertrain DTCs will set the Inspection/Maintenance (I/M) system status indicators to NO.” According to the OEM Warranty Transaction History, the service was performed on the Chevrolet in November 2018 at an OEM dealership in Florida. The vehicle’s odometer reading on the day of service was 72,410 km (44,994 mi). During the SCI inspection, OEM performed a systems-diagnostics scan of the Chevrolet and furnished SCI with a copy of the report. The power steering control module component of this report indicated: No DTCs stored. The EDR report indicated that DTCs were cleared 37 ignition cycles prior to the systems-diagnostics scan. The odometer reading at the time of the scan was unknown.

The investigation, including vehicle and scene inspections, the EDR report, the review of OEM warranty and service records, the vehicle history report, the police report, and the medical records, did not identify any evidence that a steering system malfunction occurred either prior to, or during, this crash. During the SCI vehicle inspection, the undercarriage, steering assembly, and steering column were examined and photographed with no visible damage noted. The vehicle was not in drivable condition and testing of the steering functionality at speed was not possible. The OEM representatives performed a system scan that revealed no DTCs relating to the steering system. With the vehicle engine engaged and the transmission selector in Park mode, the steering wheel was turned left and right and exhibited no unusual tendencies aside from some limitation of movement due to restriction of the right front tire caused by crush damage. No looseness or play in the steering column was noted. The steering column was configured with tilt and telescoping functionality and was set to full down and full forward positions without play or movement in either direction. The steering wheel including rim, spokes, and hub exhibited no indication of driver loading, deformation, or other damage other than the driver’s frontal air bag, which was exposed in a deployed and deflated state; the air bag appeared to have deployed normally, and the cover flaps appeared to have opened at their designated tear points. The steering wheel rim was equipped with an aftermarket wrap cover of an unknown brand.

NHTSA Recalls and Investigations

A search last queried in June 2020 using the Chevrolet’s VIN and a review of OEM warranty data indicated that the vehicle was subject to one open recall and three closed recalls as stated in the following table:

Type	Number	Original Nbr	Description	Release Date	Status
Product Safety Recall	N192268490	N192268490	Increased Brake Pedal Effort	09/06/2019	Open
Product Safety Recall	N182156820	18289	EPS Loss of Steering Assist	09/07/2018	Closed
Product Safety Recall	2016007	16007	Frontal Airbag and Pretensioner Non-Deploy	09/08/2016	Closed

Type	Number	Original Nbr	Description	Release Date	Status
Product Safety Recall	N150822	15822	Seatbelt Lap Anchor Tensioner Cable	04/11/2016	Closed

Event Data Recorder

The Chevrolet was equipped with a sensing diagnostic module (SDM) with EDR capability. The EDR was imaged by SCI during the vehicle inspection via the data link connector method using Bosch CDR software version 19.1.1. The data was reported using software version 19.4 and is included in this technical report as **Appendix A**. According to the Data Limitations, the EDR capacity is three events, including deployment and non-deployment level events. This EDR report included two deployment events and one non-deployment event, and all three events records contained pre-crash and post-crash data. The first deployment level event record was a frontal impact that triggered deployment of the driver’s frontal air bag and actuation of his seat belt pretensioner. The second deployment level event record was the rollover that triggered the deployment of the left and right IC air bags. The third event record was a non-deployment that appeared to be a left side impact with a left-to-right lateral velocity change. The EDR-reported time between events was 3.12 seconds.

The EDR did not include steering input data. For all captured events, the service brake (brake switch circuit state) was “Off,” indicating the driver did not brake throughout the crash sequence, and cruise control active was “No,” indicating it was not in use. The EDR reported identical “DTC Present at Time of Event” for the three captured events: B0052-00. Regarding this DTC, the Data Limitations stated, “For Deployment Events, DTC B0052 (Deployment commanded) shall be recorded with the remainder of the data for this event even though it occurred after Event Enable,” indicating that the DTC was not related to the vehicle’s steering system. The pre-crash data for all event records included 5.0 seconds of data in 0.5-second samples including accelerator pedal percent, service brake state, engine RPM, engine throttle percent, vehicle speed, and cruise control. The post-crash data included 300 milliseconds (ms) of longitudinal and lateral crash pulse data for captured horizontal events and 300 ms of rollover crash pulse data for the rollover event.

Interior Damage

The inspection of the interior revealed damage from impact forces, deployed air bags, and post-crash activities. The windshield and backlight were cut out to extricate the driver, and the front row left side glass was disintegrated. All doors remained closed and operational. Three air bags deployed and two seat belt pretensioners actuated. The interior did not reveal any spacial reduction due to intrusion.

Manual Restraint Systems

The front row was equipped with driver and front right passenger lap and shoulder seat belts configured with retractor pretensioners. The driver’s belt was equipped with continuous loop belt webbing, sliding latch plate, emergency locking retractor (ELR), and an adjustable shoulder anchor. It was equipped with an aftermarket shoulder pad of an unknown brand. The driver was belted at the time of the crash and his seat belt pretensioner actuated at the first tree impact

locking the belt in the used position. The driver’s belt exhibited evidence of loading on the webbing.

Supplemental Restraint Systems

The Chevrolet was equipped with frontal air bags and seat-mounted side air bags for the front-row occupants, and IC air bags for both rows. The driver’s frontal air bag deployed at the first tree impact (Event 2), and his IC air bag deployed during the rollover (Event 8). Both air bags appeared to have deployed normally. The left IC air bag sustained damage during post-crash activities.

2015 CHEVROLET SILVERADO OCCUPANT

Driver Demographics

Age/sex: 68 years/male
 Height: 191 cm (75 in)
 Weight: 108 kg (238 lb)
 Eyewear: Unknown
 Seat type: Bucket
 Seat track position: Unknown
 Manual restraint usage: Lap and shoulder belt used
 Usage source: Vehicle inspection, EDR report
 Air bags: Frontal and IC air bags deployed, seat-mounted side-impact air bag not deployed
 Alcohol/drug data: None
 Egress from vehicle: Removed through windshield while unresponsive
 Transport from scene: Ambulance to hospital
 Type of medical treatment: Declared deceased prior to admission

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Laceration, left elbow	710602.1	Left side glass	Probable
	Pre-existing conditions: diabetes mellitus, pacemaker, cardiomegaly with coronary atherosclerosis, cerebral atherosclerosis, cirrhosis of the liver with ascites, atherosclerotic cardiovascular disease			

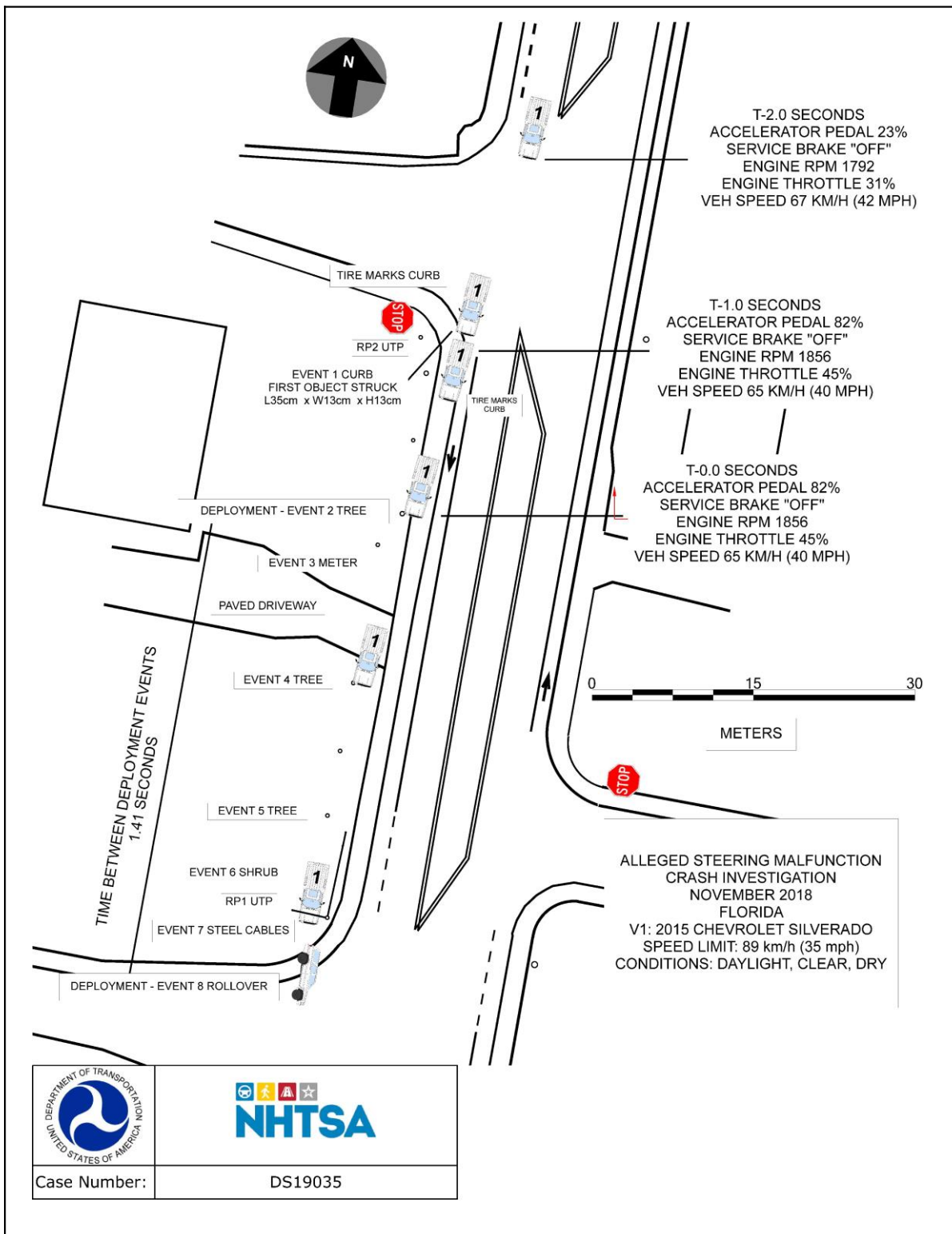
Source: autopsy report.

Driver Kinematics

The belted 68-year-old male driver was seated in an unknown posture. He was presumably steering the vehicle while applying constant accelerator pedal pressure. Due to reasons possibly relating to a disabling medical condition, the driver lost control of the vehicle, and it traveled off the right edge of the roadway and over a raised curb. This was a low-delta-V event, and he remained in his seated position. The front plane of the Chevrolet then struck a palm tree, causing the deployment of the driver’s frontal air bag and the actuation of his seat belt pretensioner. The

driver was displaced forward loading the belt and air bag with his chest while remaining seated. The vehicle continued traveling off-road while striking another tree, a utility meter, and a shrub in low-delta-V frontal events. The vehicle then struck two steel cables supporting a utility pole, which caused the vehicle to overturn left-side leading and causing the deployment of the driver's IC air bag before coming to rest on its left plane. The driver was displaced to the left, and his left elbow possibly contacted fractured left-side glass causing a minor laceration, which was determined to be his only crash-related injury. Deposits appearing to be dried blood were present on the left roof header of the interior front row. Emergency responders found the driver to be unresponsive. They removed the windshield, creating an opening of sufficient size and extricated the driver through it. The driver was transported by an ambulance to a local hospital, where efforts to resuscitate him were unsuccessful, and he was declared deceased. The cause of death was determined to be atherosclerotic cardiovascular disease. A contributory condition was diabetes mellitus, and the manner of death was natural.

CRASH DIAGRAM



 DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA	 NHTSA
Case Number:	DS19035

APPENDIX A: 2015 Chevrolet Silverado Event Data Recorder (EDR) Report⁵

⁵ 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 view 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	3GCPCREC6FG*****
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	DS19035_V1_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 19.1.1
Imaged with Software Licensed to (Company Name)	NHTSA
Reported with CDR version	Crash Data Retrieval Tool 19.4
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Deployment, Deployment, Non-Deployment

Comments

No comments entered.

Data Limitations

Recorded Crash Events:

There are two types of recorded crash events for Front, Side, and Rear (FSR) 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 [8 km/h]. A Non-Deployment Event contains Pre-Crash and Crash data. The oldest Non-Deployment event can be overwritten by a Deployment Event, if all three records are full and the Non-Deployment Event is not locked. A Non-Deployment Event can be overwritten by a more recent Non-Deployment Event if all three records are full and the Non-Deployment is older than approximately 250 ignition cycles. Also, a Non-Deployment event can be recorded if one of the following occurs without the Deployment of any of the frontal air bags, side air bags, or roll bars:

- Pretensioner(s) only Deployment
- Head Rest Deployment
- Battery Cut-Off Deployment

The second type of SDM recorded crash event for FSR Events is the Deployment Event. It also contains Pre-Crash and Crash data. Deployment Events cannot be overwritten or cleared by the SDM.

Rollover Events contains Pre-Crash and Crash data. Rollover event follow the same rules as FSR Deployment events.

The SDM can store up to three Events.

Data:

For FSR Events, 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 and Non-Deployment Events, the SDM will record up to 300 milliseconds of data after time zero. The SDM will also record up to 300 milliseconds of Vehicle Acceleration data after time zero.

For Rollover Events, the SDM may record Lateral Acceleration, Vertical Acceleration, and Roll Rate data, if the SDM is rollover capable. This data reflects what the sensing system experienced during the recorded portion of the event. For Rollover Deployment Events, the SDM will record up to 700 milliseconds of data before the Deployment criteria is met and 290 milliseconds after the Deployment criteria is met.

-Deployment loops may be displayed as being deployed in a Non-Deployment event record, if a Deployment event is qualified during the Non-Deployment event. That is, if two or more events are occurring at the same time and one is a Non-Deployment event and one of the others is a Deployment event, and the Deployment event is qualified while the Non-Deployment is still active, the deployed loops may be recorded in the Non-Deployment event record.

-Time between events is recorded in 10 msec intervals and is displayed in seconds for a maximum time of 655.33 seconds. The counter measures the time from the start of one event to the start of the next event if both events occur within the same ignition cycle.

-The Maximum SDM Recorded Vehicle Velocity Change may occur between the recorded 10 millisecond sample points of the SDM Recorded Vehicle Velocity Change. The SDM will only record Maximum SDM Recorded Vehicle Velocity Change for the first 300 milliseconds of the event.

-If the SDM Recorded Vehicle Velocity Change data exceeds the max output range of -127 km/h then the exceeded values will be displayed with an offset of a +256 km/h. If the SDM Recorded Vehicle Velocity Change data exceeds the max output range of +126

- km/h then the exceeded values will be displayed with an offset of a -256 km/h.
- 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 0.5 second Pre-crash data value (most recent recorded data point) is the data point last sampled before Time Zero. That is to say, the last data point may have been captured just before Time Zero but no more than 0.5 second before Time Zero. 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
- Pre-Crash Electronic Data Validity Check Status indicates "Data Not Available" if:
 - No data is received from the module sending the pre-crash data
- For diesel powered vehicles, the data displayed as Throttle Position (%) is actually the data for the Air Inlet Flap Position. This is not the same as the throttle position for a gasoline powered engine.
- Belt Switch Circuit Status indicates the status of the seat belt switch circuit.
- The ignition cycle counter will increment when the power mode cycles from OFF/Accessory to RUN. Applying and removing of battery power to the module will not increment the ignition cycle counter.
- Ignition Cycles Since DTCs Were Last Cleared can record a maximum value of 253 cycles and can only be reset by a scan tool.
- Dynamic Deployment Event Counter tracks the number of Deployment events that have occurred during the SDM's lifetime.
- Dynamic Event Counter tracks the number of qualified events (either Deployments, Non-deploy, or Rollover events) that have occurred during the SDM's lifetime.
- For Deployment Events, DTC B0052 (Deployment commanded) shall be recorded with the remainder of the data for this event even though it occurred after Event Enable.
- Once a firing loop has been commanded to be deployed, it will not be commanded to be deployed again during the same ignition cycle. Firing loop times for subsequent deployment type events, during the same ignition cycle, will record the deployment times as N/A.
- In an event where the module is operating on energy reserve, the Dynamic counters may report a value that is less than the actual value. If the stored values in the Dynamic counters are less than the counter values in the event records or if more than one event record has the same counter value as another, the module may have been operating on its energy reserve.
- A Concurrent Event is when two events are happening nearly simultaneously. The "Concurrent Event Flag Set" parameter will indicate "Yes" if one event begins, but before that event is qualified, another event begins and is qualified.
- A Non-Deployment event typically becomes qualified if that event exceeds the 5 MPH (8 km/h) delta V recording threshold and the event has concluded. A deployment event (FSR or Rollover) becomes qualified when a deployment has been commanded for that event.
- Example of a Concurrent Event:
A Rollover event begins. Before the Rollover event is qualified, a Non-Deployment event begins and is qualified. Sometime after the Non-Deployment event is qualified, the Rollover event is qualified. The Non-Deployment event will be recorded in the first open record even though the Rollover event enabled before the Non-Deployment event. The Rollover event will be recorded in the next open record. The "Concurrent Event Flag Set" parameter will indicate "Yes" for the Rollover event. The "Time Between Events" parameter will indicate the time from the start of the Rollover event to the start of the Non-Deployment event.
- The GM parameter name is displayed in parentheses after the NHTSA Part 563 parameter name.
- The reported range of the longitudinal and lateral acceleration values is approximately ± 50 g.
- Due to a CDR Tool data imaging issue, all CDR files imaged from SDM-30 Delphi airbag control modules (ACM) using version 17.6 software are invalid and the ACM must be re-imaged using CDR version 17.6.1 and later software.
- 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 by the Body Control Module, 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 Acceleration	Forward
Longitudinal Velocity Change	Forward
Lateral Acceleration	Left to Right
Lateral Velocity Change	Left to Right
Vertical Acceleration	Downward
Roll Rate	Clockwise 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.

01050_SDM30-delphi_r019

System Status at Time of Retrieval

Dynamic Deployment Event Counter	2
Multi-Event, Number of Events (Dynamic Event Counter)	3
Dynamic OnStar Notification Event Counter	3
Vehicle Identification Number (VIN)	3GCPCREC6FG*****
Ignition Cycle, Download (Ignition Cycles at Investigation)	9593
End Model Part Number	00CF6F22
System Type	N/A
Software Module Identifier 1	00CE44D6
Software Module Identifier 2	016214F4
Software Module Identifier 3	01621D42
Manufacturing Traceability Data, LineID	K
Manufacturing Traceability Data, ShiftID	2
Manufacturing Traceability Data, Year	14
Manufacturing Traceability Data, DayOfTheYear	234
Manufacturing Traceability Data, Serial/Lot/BatchNumber	3M0YDXT00
ESS # 1 Traceability Data, Component Identifier	AU
ESS # 1 Traceability Data, Part Number/Broadcast Code	8677
ESS # 1 Traceability Data, Supplier Code	D
ESS # 1 Traceability Data, Traceability Number	P00000000
ESS # 2 Traceability Data, Component Identifier	AT
ESS # 2 Traceability Data, Part Number/Broadcast Code	8677
ESS # 2 Traceability Data, Supplier Code	D
ESS # 2 Traceability Data, Traceability Number	P00000000
ESS # 3 Traceability Data, Component Identifier	AH
ESS # 3 Traceability Data, Part Number/Broadcast Code	8676
ESS # 3 Traceability Data, Supplier Code	D
ESS # 3 Traceability Data, Traceability Number	A00000000
ESS # 4 Traceability Data, Component Identifier	AJ
ESS # 4 Traceability Data, Part Number/Broadcast Code	8676
ESS # 4 Traceability Data, Supplier Code	D
ESS # 4 Traceability Data, Traceability Number	A00000000
ESS # 5 Traceability Data, Component Identifier	DA
ESS # 5 Traceability Data, Part Number/Broadcast Code	8678
ESS # 5 Traceability Data, Supplier Code	D
ESS # 5 Traceability Data, Traceability Number	A00000000
ESS # 6 Traceability Data, Component Identifier	DB
ESS # 6 Traceability Data, Part Number/Broadcast Code	8678
ESS # 6 Traceability Data, Supplier Code	D
ESS # 6 Traceability Data, Traceability Number	A00000000
ESS # 7 Traceability Data, Component Identifier	??
ESS # 7 Traceability Data, Part Number/Broadcast Code	0000
ESS # 7 Traceability Data, Supplier Code	D
ESS # 7 Traceability Data, Traceability Number	A00000000
ESS # 8 Traceability Data, Component Identifier	??
ESS # 8 Traceability Data, Part Number/Broadcast Code	0000
ESS # 8 Traceability Data, Supplier Code	D
ESS # 8 Traceability Data, Traceability Number	A00000000

System Status at Event (Event Record 1)

Event Record Type	Deployment
OnStar Deployment Status Data Sent	Yes
Complete file recorded (Event Recording Complete)	Yes
Crash Record Locked	Yes
OnStar SDM Recorded Vehicle Velocity Change Data Sent	Yes
Deployment Event Counter	1
Multi-Event, Number of Events (Event Counter)	1
OnStar Notification Event Counter	1
Time From Event 1 to 2 (Time Between Events) (seconds)	Data Not Available
Ignition Cycle, Crash (Ignition Cycles at Event)	9590
Algorithm Active: Frontal	Yes
Algorithm Active: Side	Yes
Algorithm Active: Rollover	Yes
Algorithm Active: Rear	Yes
Concurrent Event Flag Set	No
Event Severity Status: Frontal Pretensioner	Yes
Event Severity Status: Frontal Stage 1	Yes
Event Severity Status: Frontal Stage 2	No
Event Severity Status: Left Side	No
Event Severity Status: Right Side	No
Event Severity Status: Rear	No
Event Severity Status: Rollover	No
Safety Belt Status, Driver (Driver Belt Switch Circuit Status)	Buckled
Safety Belt Status, Right Front Passenger (Passenger Belt Switch Circuit Status)	Not Buckled
Center Front Row Belt Switch Circuit Status (If Equipped)	Data Not Available
Left Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Center Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Right Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Seat Track Position Switch, Foremost, Status, Driver (Driver Seat Position Status)	No (Rearward)
Seat Track Position Switch, Foremost, Status, Right Front Passenger (Passenger Seat Position Status)	No (Rearward)
Passenger Seat Occupancy Status	Empty
Occupant Size Right Front Passenger Child (Passenger Classification Status)	No (Not Applicable)
Passenger Air Bag ON Indicator Status	Off
Passenger Air Bag OFF Indicator Status	On
Low Tire Pressure Warning Lamp Status 0.5 Seconds Prior to Time Zero	Off
Frontal Air Bag Warning Lamp (SIR Warning Lamp Status 0.5 Seconds Prior to Time Zero)	Off
SIR Warning Lamp ON/OFF Time Continuously (seconds)	655330
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	4184
Ignition Cycles Since DTCs Were Last Cleared 0.5 Seconds Prior to Time Zero	37
Maximum Delta-V, Longitudinal (Maximum Longitudinal SDM Recorded Vehicle Velocity Change for FSR Event) MPH [km/h]	-14 [-22]
Time, Maximum Delta-V (Time From FSR Time Zero to Maximum Longitudinal SDM Recorded Vehicle Velocity Change)(msec)	300
Maximum Delta-V, Lateral (Maximum Lateral SDM Recorded Vehicle Velocity Change for FSR Event) MPH [km/h]	1 [1]
Time Maximum Delta-V, Lateral (Time From FSR Time Zero to Maximum Lateral SDM Recorded Vehicle Velocity Change)(msec)	140
High Voltage Disable Notification Sent	Yes
Deployment Commanded in Energy Reserve Mode	No

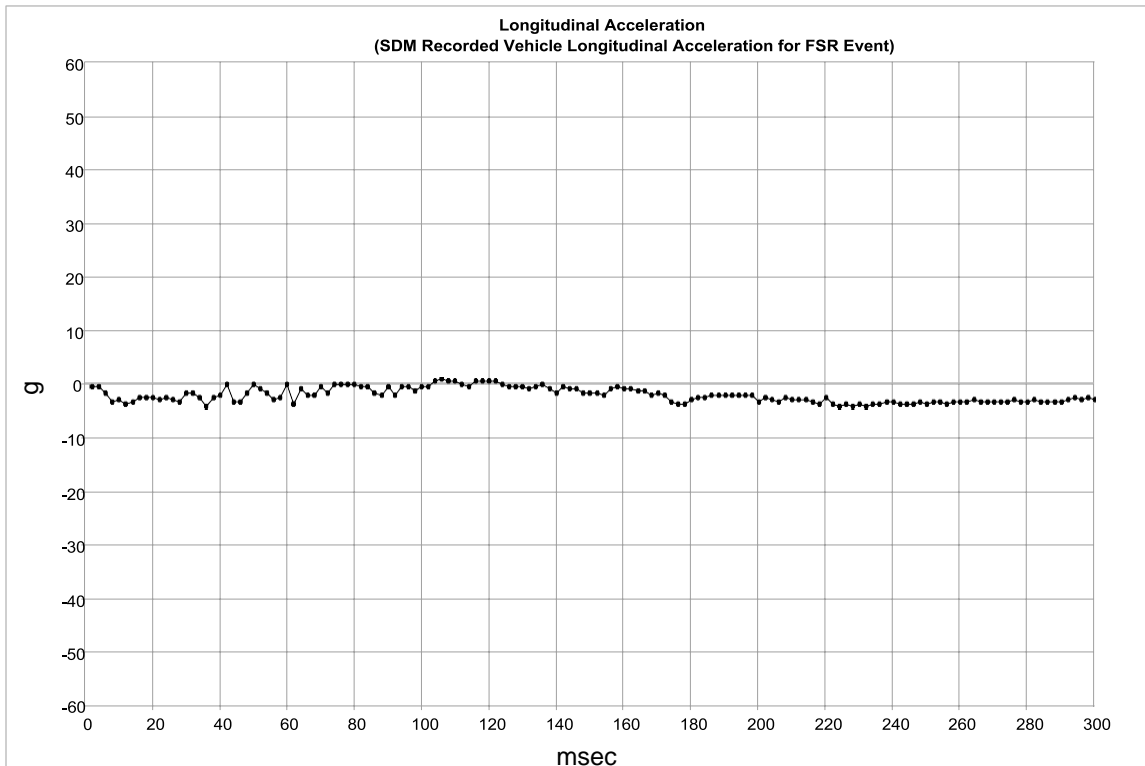
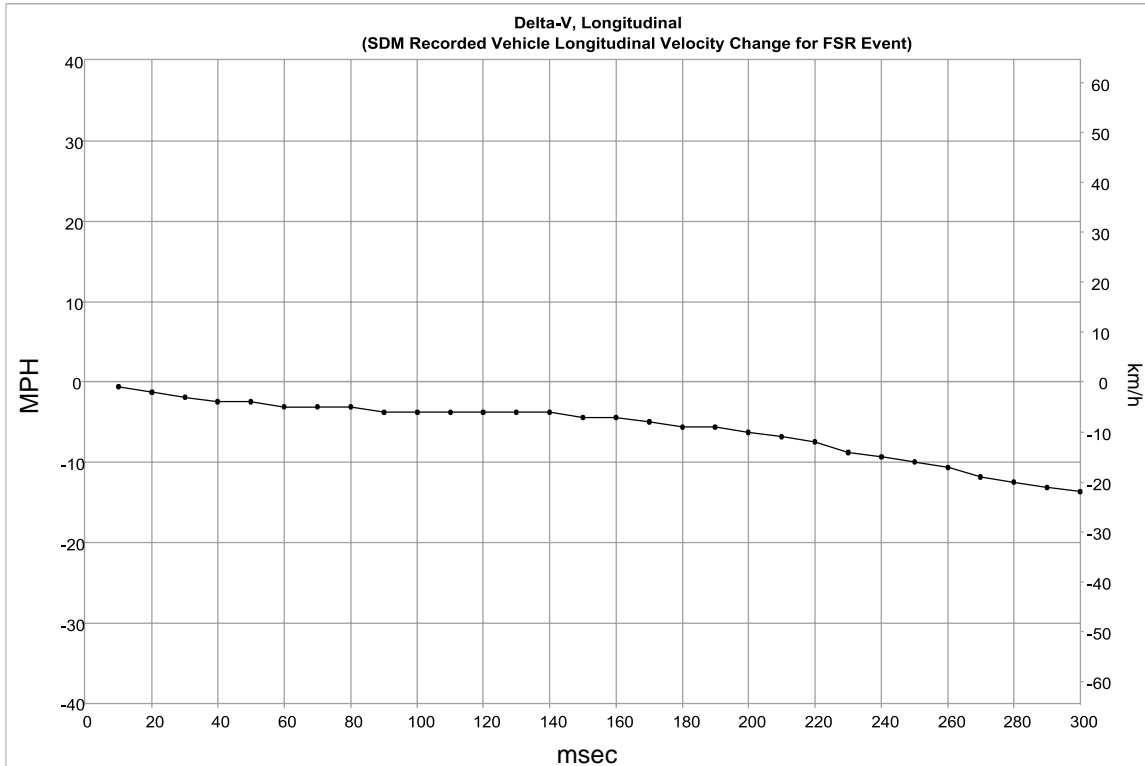
DTCs Present at Time of Event (Event Record 1)

B0052-00

Event Data (Event Record 1)

Driver 1st Stage Deployment Loop Commanded	Yes
Passenger 1st Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop #1 Commanded	Yes
Passenger Pretensioner Deployment Loop #1 Commanded	Yes
Driver Pretensioner Deployment Loop #2 Commanded	Yes
Passenger Pretensioner Deployment Loop #2 Commanded	Yes
Driver Thorax Loop Commanded	No
Passenger Thorax Loop Commanded	No
Left Row 1 Roof Rail/Head Curtain Loop Commanded	No
Right Row 1 Roof Rail/Head Curtain Loop Commanded	No
Frontal Air Bag Deployment, Time to 1st Stage Deployment, Driver (Driver 1st Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	45
Frontal Air Bag Deployment, Time to 2nd Stage, Driver (Driver 2nd Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Frontal Air Bag Deployment, Time to 1st Stage Deployment, Right Front Passenger (Passenger 1st Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (Passenger 2nd Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Side air bag deployment, time to deploy, driver (Driver Thorax/Curtain Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Side air bag deployment, time to deploy, right front passenger (Passenger Thorax/Curtain Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Pretensioner Deployment, Time to Fire, Driver (Driver Pretensioner Time From Time Zero to Deployment Loop #1 or Loop #2 Command Criteria Met) (msec)	30
Pretensioner Deployment, Time to Fire, Right Front Passenger (Passenger Pretensioner Time From Time Zero to Deployment Loop #1 or Loop #2 Command Criteria Met) (msec)	30

Longitudinal Crash Pulse (Event Record 1)



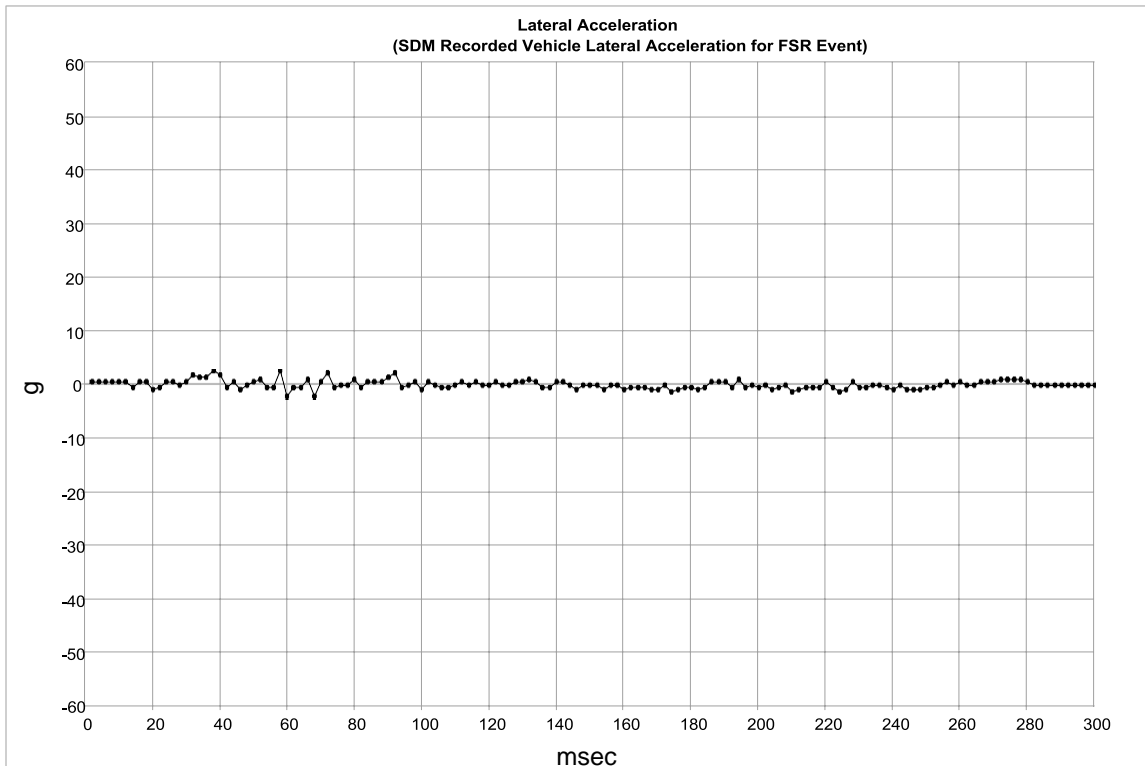
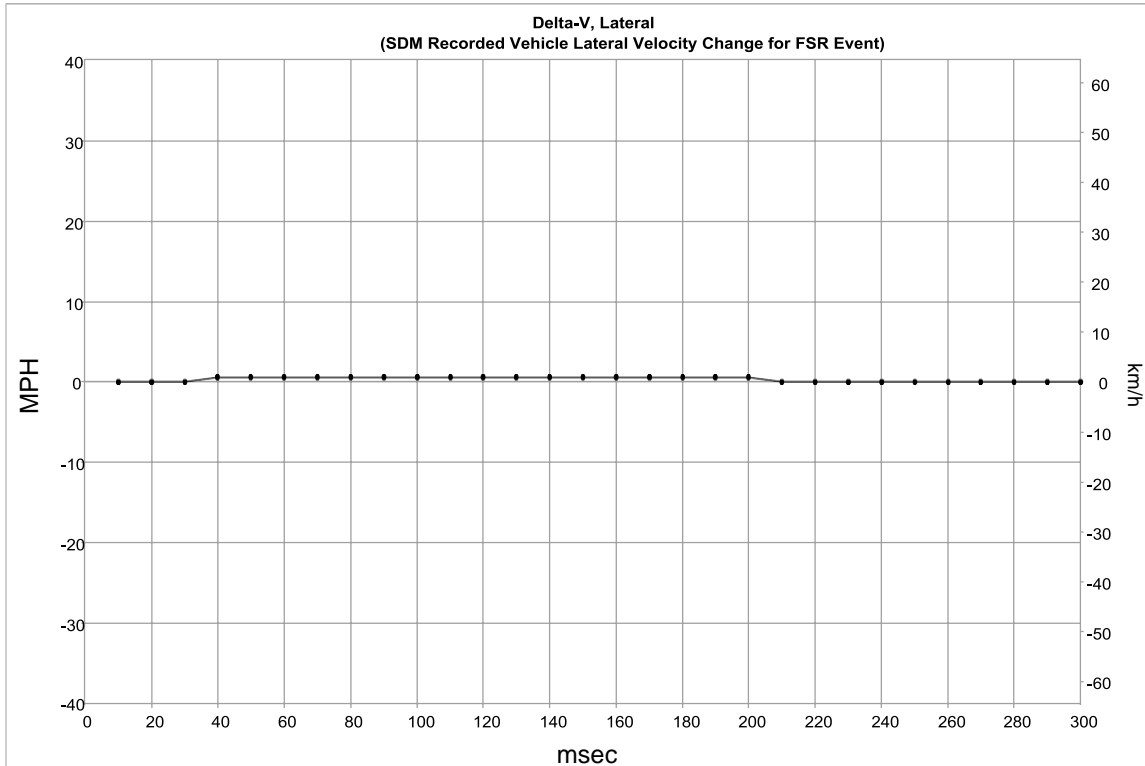
Longitudinal Crash Pulse (Event Record 1)

Time (msec)	Delta-V, Longitudinal (SDM Recorded Vehicle Longitudinal Velocity Change for FSR Event) (MPH)	Delta-V, Longitudinal (SDM Recorded Vehicle Longitudinal Velocity Change for FSR Event) (km/h)
10	-0.6	-1.0
20	-1.2	-2.0
30	-1.9	-3.0
40	-2.5	-4.0
50	-2.5	-4.0
60	-3.1	-5.0
70	-3.1	-5.0
80	-3.1	-5.0
90	-3.7	-6.0
100	-3.7	-6.0
110	-3.7	-6.0
120	-3.7	-6.0
130	-3.7	-6.0
140	-3.7	-6.0
150	-4.3	-7.0
160	-4.3	-7.0
170	-5.0	-8.0
180	-5.6	-9.0
190	-5.6	-9.0
200	-6.2	-10.0
210	-6.8	-11.0
220	-7.5	-12.0
230	-8.7	-14.0
240	-9.3	-15.0
250	-9.9	-16.0
260	-10.6	-17.0
270	-11.8	-19.0
280	-12.4	-20.0
290	-13.0	-21.0
300	-13.7	-22.0

Longitudinal Crash Pulse (Event Record 1)

Time (msec)	Longitudinal Acceleration (SDM Recorded Vehicle Longitudinal Acceleration for FSR Event) (g)	Time (msec)	Longitudinal Acceleration (SDM Recorded Vehicle Longitudinal Acceleration for FSR Event) (g)	Time (msec)	Longitudinal Acceleration (SDM Recorded Vehicle Longitudinal Acceleration for FSR Event) (g)
2	-0.6	102	-0.6	202	-2.6
4	-0.6	104	0.2	204	-3.0
6	-1.8	106	0.6	206	-3.4
8	-3.4	108	0.2	208	-2.6
10	-3.0	110	0.2	210	-3.0
12	-3.8	112	-0.2	212	-3.0
14	-3.4	114	-0.6	214	-3.0
16	-2.6	116	0.2	216	-3.4
18	-2.6	118	0.2	218	-3.8
20	-2.6	120	0.2	220	-2.6
22	-3.0	122	0.2	222	-3.8
24	-2.6	124	-0.2	224	-4.2
26	-3.0	126	-0.6	226	-3.8
28	-3.4	128	-0.6	228	-4.2
30	-1.8	130	-0.6	230	-3.8
32	-1.8	132	-1.0	232	-4.2
34	-2.6	134	-0.6	234	-3.8
36	-4.2	136	-0.2	236	-3.8
38	-2.6	138	-1.0	238	-3.4
40	-2.2	140	-1.8	240	-3.4
42	-0.2	142	-0.6	242	-3.8
44	-3.4	144	-1.0	244	-3.8
46	-3.4	146	-1.0	246	-3.8
48	-1.8	148	-1.8	248	-3.4
50	-0.2	150	-1.8	250	-3.8
52	-1.0	152	-1.8	252	-3.4
54	-1.8	154	-2.2	254	-3.4
56	-3.0	156	-1.0	256	-3.8
58	-2.6	158	-0.6	258	-3.4
60	-0.2	160	-1.0	260	-3.4
62	-3.8	162	-1.0	262	-3.4
64	-1.0	164	-1.4	264	-3.0
66	-2.2	166	-1.4	266	-3.4
68	-2.2	168	-2.2	268	-3.4
70	-0.6	170	-1.8	270	-3.4
72	-1.8	172	-2.2	272	-3.4
74	-0.2	174	-3.4	274	-3.4
76	-0.2	176	-3.8	276	-3.0
78	-0.2	178	-3.8	278	-3.4
80	-0.2	180	-3.0	280	-3.4
82	-0.6	182	-2.6	282	-3.0
84	-0.6	184	-2.6	284	-3.4
86	-1.8	186	-2.2	286	-3.4
88	-2.2	188	-2.2	288	-3.4
90	-0.6	190	-2.2	290	-3.4
92	-2.2	192	-2.2	292	-3.0
94	-0.6	194	-2.2	294	-2.6
96	-0.6	196	-2.2	296	-3.0
98	-1.4	198	-2.2	298	-2.6
100	-0.6	200	-3.4	300	-3.0

Lateral Crash Pulse (Event Record 1)



Lateral Crash Pulse (Event Record 1)

Time (msec)	Delta-V, Lateral (SDM Recorded Vehicle Lateral Velocity Change for FSR Event) (MPH)	Delta-V, Lateral (SDM Recorded Vehicle Lateral Velocity Change for FSR Event) (km/h)
10	0.0	0.0
20	0.0	0.0
30	0.0	0.0
40	0.6	1.0
50	0.6	1.0
60	0.6	1.0
70	0.6	1.0
80	0.6	1.0
90	0.6	1.0
100	0.6	1.0
110	0.6	1.0
120	0.6	1.0
130	0.6	1.0
140	0.6	1.0
150	0.6	1.0
160	0.6	1.0
170	0.6	1.0
180	0.6	1.0
190	0.6	1.0
200	0.6	1.0
210	0.0	0.0
220	0.0	0.0
230	0.0	0.0
240	0.0	0.0
250	0.0	0.0
260	0.0	0.0
270	0.0	0.0
280	0.0	0.0
290	0.0	0.0
300	0.0	0.0

Lateral Crash Pulse (Event Record 1)

Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for FSR Event) (g)	Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for FSR Event) (g)	Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for FSR Event) (g)
2	0.2	102	0.2	202	-0.2
4	0.2	104	-0.2	204	-1.0
6	0.2	106	-0.6	206	-0.6
8	0.2	108	-0.6	208	-0.2
10	0.2	110	-0.2	210	-1.4
12	0.2	112	0.2	212	-1.0
14	-0.6	114	-0.2	214	-0.6
16	0.2	116	0.2	216	-0.6
18	0.2	118	-0.2	218	-0.6
20	-1.0	120	-0.2	220	0.2
22	-0.6	122	0.2	222	-0.6
24	0.2	124	-0.2	224	-1.4
26	0.2	126	-0.2	226	-1.0
28	-0.2	128	0.2	228	0.2
30	0.2	130	0.2	230	-0.6
32	1.4	132	0.6	232	-0.6
34	1.0	134	0.2	234	-0.2
36	1.0	136	-0.6	236	-0.2
38	2.2	138	-0.6	238	-0.6
40	1.4	140	0.2	240	-1.0
42	-0.6	142	0.2	242	-0.2
44	0.2	144	-0.2	244	-1.0
46	-1.0	146	-1.0	246	-1.0
48	-0.2	148	-0.2	248	-1.0
50	0.2	150	-0.2	250	-0.6
52	0.6	152	-0.2	252	-0.6
54	-0.6	154	-1.0	254	-0.2
56	-0.6	156	-0.2	256	0.2
58	2.2	158	-0.2	258	-0.2
60	-2.2	160	-1.0	260	0.2
62	-0.6	162	-0.6	262	-0.2
64	-0.6	164	-0.6	264	-0.2
66	0.6	166	-0.6	266	0.2
68	-2.2	168	-1.0	268	0.2
70	0.2	170	-1.0	270	0.2
72	1.8	172	-0.2	272	0.6
74	-0.6	174	-1.4	274	0.6
76	-0.2	176	-1.0	276	0.6
78	-0.2	178	-0.6	278	0.6
80	0.6	180	-0.6	280	0.2
82	-0.6	182	-1.0	282	-0.2
84	0.2	184	-0.6	284	-0.2
86	0.2	186	0.2	286	-0.2
88	0.2	188	0.2	288	-0.2
90	1.0	190	0.2	290	-0.2
92	1.8	192	-0.6	292	-0.2
94	-0.6	194	0.6	294	-0.2
96	-0.2	196	-0.6	296	-0.2
98	0.2	198	-0.2	298	-0.2
100	-1.0	200	-0.6	300	-0.2

**Rollover Crash Pulse (Event Record 1)
SDM Recorded Vehicle Roll Rate**

Contains No Recorded Data

**Rollover Crash Pulse (Event Record 1)
Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for Rollover
Event)**

Contains No Recorded Data

**Vertical Crash Pulse (Event Record 1)
Normal Acceleration (SDM Recorded Vehicle Vertical Acceleration for Rollover
Event)**

Contains No Recorded Data

Pre-Crash Data -5.0 to -0.5 sec (Event Record 1)

Times (sec)	Accelerator Pedal, % Full (Accelerator Pedal Position)	Service Brake (Brake Switch Circuit State)	Engine RPM (Engine Speed)	Engine Throttle, % Full (Throttle Position)	Speed, Vehicle Indicated (Vehicle Speed) (MPH [km/h])
-5.0	41	Off	2368	38	37 [60]
-4.5	41	Off	2432	41	39 [62]
-4.0	40	Off	2368	39	40 [64]
-3.5	39	Off	2368	39	41 [66]
-3.0	31	Off	2432	34	42 [68]
-2.5	29	Off	2368	35	42 [67]
-2.0	23	Off	1792	31	42 [67]
-1.5	20	Off	1792	60	40 [65]
-1.0	82	Off	1856	45	40 [65]
-0.5	37	Off	3136	33	35 [56]

Pre-Crash Data -2.0 to -0.5 sec (Event Record 1)

Times (sec)	Cruise Control Active	Cruise Control Resume Switch Active	Cruise Control Set Switch Active	Engine Torque (lb-ft [N-m])	Reduced Engine Power Mode Indicator
-2.0	No	No	No	155 [210]	Off
-1.5	No	No	No	216 [292]	Off
-1.0	No	No	No	197 [266]	Off
-0.5	No	No	No	80 [108]	Off

System Status at Event (Event Record 2)

	Deployment
Event Record Type	
OnStar Deployment Status Data Sent	Yes
Complete file recorded (Event Recording Complete)	Yes
Crash Record Locked	Yes
OnStar SDM Recorded Vehicle Velocity Change Data Sent	Yes
Deployment Event Counter	2
Multi-Event, Number of Events (Event Counter)	2
OnStar Notification Event Counter	2
Time From Event 1 to 2 (Time Between Events) (seconds)	1.41
Ignition Cycle, Crash (Ignition Cycles at Event)	9590
Algorithm Active: Frontal	Yes
Algorithm Active: Side	Yes
Algorithm Active: Rollover	Yes
Algorithm Active: Rear	Yes
Concurrent Event Flag Set	Yes
Event Severity Status: Frontal Pretensioner	No
Event Severity Status: Frontal Stage 1	No
Event Severity Status: Frontal Stage 2	No
Event Severity Status: Left Side	No
Event Severity Status: Right Side	No
Event Severity Status: Rear	No
Event Severity Status: Rollover	Yes
Safety Belt Status, Driver (Driver Belt Switch Circuit Status)	Buckled
Safety Belt Status, Right Front Passenger (Passenger Belt Switch Circuit Status)	Not Buckled
Center Front Row Belt Switch Circuit Status (If Equipped)	Data Not Available
Left Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Center Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Right Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Seat Track Position Switch, Foremost, Status, Driver (Driver Seat Position Status)	No (Rearward)
Seat Track Position Switch, Foremost, Status, Right Front Passenger (Passenger Seat Position Status)	No (Rearward)
Passenger Seat Occupancy Status	Empty
Occupant Size Right Front Passenger Child (Passenger Classification Status)	No (Not Applicable)
Passenger Air Bag ON Indicator Status	Off
Passenger Air Bag OFF Indicator Status	On
Low Tire Pressure Warning Lamp Status 0.5 Seconds Prior to Time Zero	Off
Frontal Air Bag Warning Lamp (SIR Warning Lamp Status 0.5 Seconds Prior to Time Zero)	Off
SIR Warning Lamp ON/OFF Time Continuously (seconds)	655330
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	4184
Ignition Cycles Since DTCs Were Last Cleared 0.5 Seconds Prior to Time Zero	37
Maximum Delta-V, Longitudinal (Maximum Longitudinal SDM Recorded Vehicle Velocity Change for FSR Event) MPH [km/h]	Data Not Available
Time, Maximum Delta-V (Time From FSR Time Zero to Maximum Longitudinal SDM Recorded Vehicle Velocity Change)(msec)	Data Not Available
Maximum Delta-V, Lateral (Maximum Lateral SDM Recorded Vehicle Velocity Change for FSR Event) MPH [km/h]	Data Not Available
Time Maximum Delta-V, Lateral (Time From FSR Time Zero to Maximum Lateral SDM Recorded Vehicle Velocity Change)(msec)	Data Not Available
High Voltage Disable Notification Sent	Yes
Deployment Commanded in Energy Reserve Mode	No

DTCs Present at Time of Event (Event Record 2)

B0052-00

Event Data (Event Record 2)

Driver 1st Stage Deployment Loop Commanded	No
Passenger 1st Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop #1 Commanded	No
Passenger Pretensioner Deployment Loop #1 Commanded	No
Driver Pretensioner Deployment Loop #2 Commanded	No
Passenger Pretensioner Deployment Loop #2 Commanded	No
Driver Thorax Loop Commanded	No
Passenger Thorax Loop Commanded	No
Left Row 1 Roof Rail/Head Curtain Loop Commanded	Yes
Right Row 1 Roof Rail/Head Curtain Loop Commanded	Yes
Frontal Air Bag Deployment, Time to 1st Stage Deployment, Driver (Driver 1st Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Frontal Air Bag Deployment, Time to 2nd Stage, Driver (Driver 2nd Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Frontal Air Bag Deployment, Time to 1st Stage Deployment, Right Front Passenger (Passenger 1st Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (Passenger 2nd Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Side air bag deployment, time to deploy, driver (Driver Thorax/Curtain Time From Time Zero to Deployment Command Criteria Met) (msec)	253
Side air bag deployment, time to deploy, right front passenger (Passenger Thorax/Curtain Time From Time Zero to Deployment Command Criteria Met) (msec)	253
Pretensioner Deployment, Time to Fire, Driver (Driver Pretensioner Time From Time Zero to Deployment Loop #1 or Loop #2 Command Criteria Met) (msec)	Data Not Available
Pretensioner Deployment, Time to Fire, Right Front Passenger (Passenger Pretensioner Time From Time Zero to Deployment Loop #1 or Loop #2 Command Criteria Met) (msec)	Data Not Available

**Longitudinal Crash Pulse (Event Record 2)
Delta-V, Longitudinal (SDM Recorded Vehicle Longitudinal Velocity Change for
FSR Event)**

Contains No Recorded Data

**Longitudinal Crash Pulse (Event Record 2)
Longitudinal Acceleration (SDM Recorded Vehicle Longitudinal Acceleration for
FSR Event)**

Contains No Recorded Data

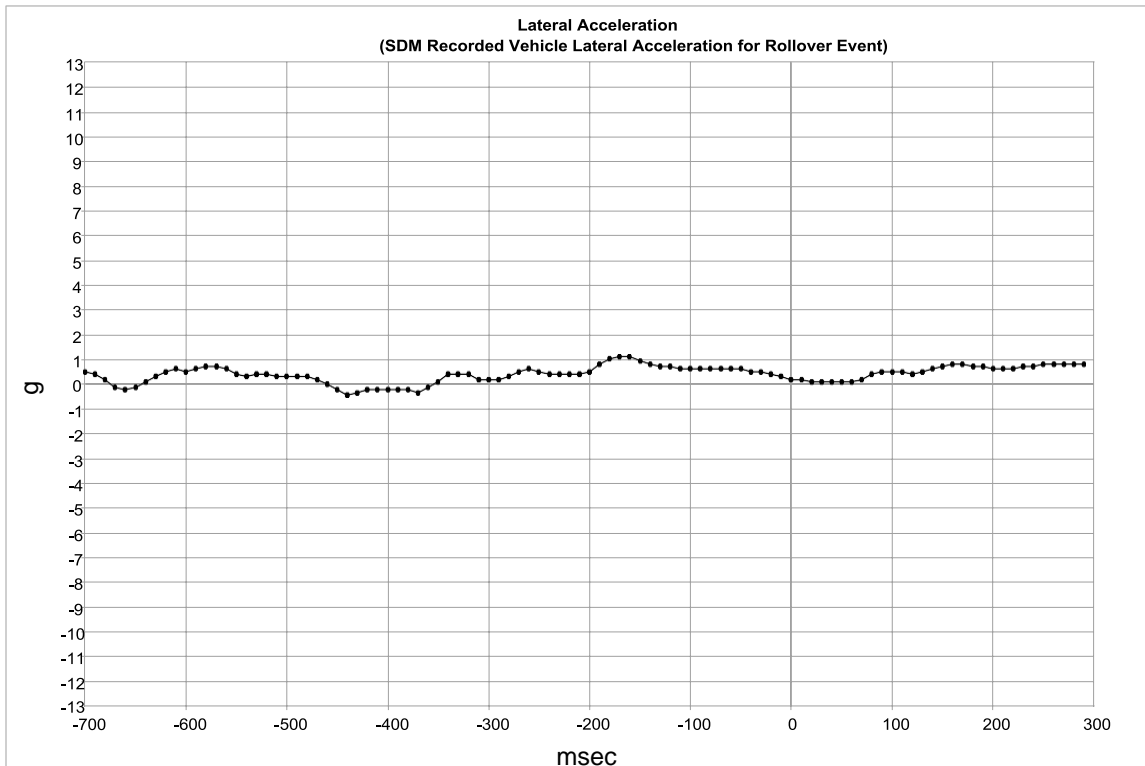
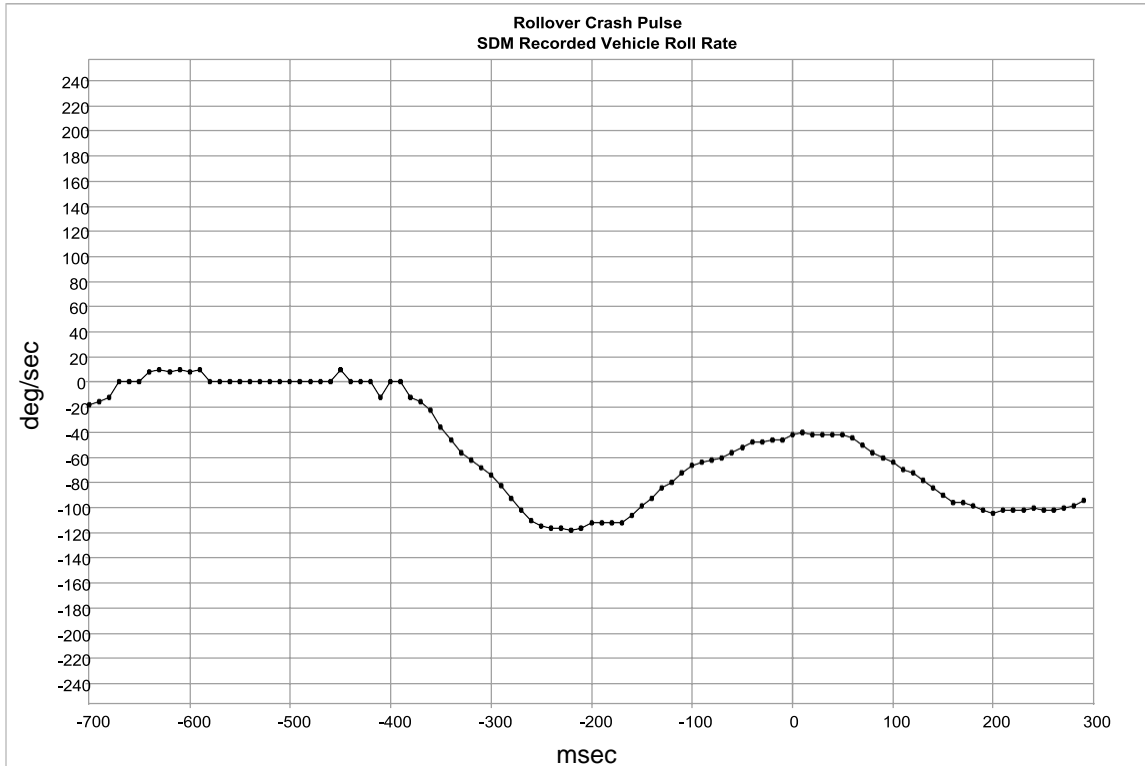
**Lateral Crash Pulse (Event Record 2)
Delta-V, Lateral (SDM Recorded Vehicle Lateral Velocity Change for FSR Event)**

Contains No Recorded Data

**Lateral Crash Pulse (Event Record 2)
Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for FSR Event)**

Contains No Recorded Data

Rollover Crash Pulse (Event Record 2)



Rollover Crash Pulse (Event Record 2)

Time (msec)	SDM Recorded Vehicle Roll Rate (deg/sec)	Time (msec)	SDM Recorded Vehicle Roll Rate (deg/sec)
-700	-18	-200	-112
-690	-16	-190	-112
-680	-12	-180	-112
-670	0	-170	-112
-660	0	-160	-106
-650	0	-150	-98
-640	8	-140	-92
-630	10	-130	-84
-620	8	-120	-80
-610	10	-110	-72
-600	8	-100	-66
-590	10	-90	-64
-580	0	-80	-62
-570	0	-70	-60
-560	0	-60	-56
-550	0	-50	-52
-540	0	-40	-48
-530	0	-30	-48
-520	0	-20	-46
-510	0	-10	-46
-500	0	0	-42
-490	0	10	-40
-480	0	20	-42
-470	0	30	-42
-460	0	40	-42
-450	10	50	-42
-440	0	60	-44
-430	0	70	-50
-420	0	80	-56
-410	-12	90	-60
-400	0	100	-64
-390	0	110	-70
-380	-12	120	-72
-370	-16	130	-78
-360	-22	140	-84
-350	-36	150	-90
-340	-46	160	-96
-330	-56	170	-96
-320	-62	180	-98
-310	-68	190	-102
-300	-74	200	-104
-290	-82	210	-102
-280	-92	220	-102
-270	-102	230	-102
-260	-110	240	-100
-250	-114	250	-102
-240	-116	260	-102
-230	-116	270	-100
-220	-118	280	-98
-210	-116	290	-94

Rollover Crash Pulse (Event Record 2)

Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for Rollover Event) (g)	Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for Rollover Event) (g)
-700	0.5	-200	0.5
-690	0.4	-190	0.8
-680	0.2	-180	1.0
-670	-0.1	-170	1.1
-660	-0.2	-160	1.1
-650	-0.1	-150	0.9
-640	0.1	-140	0.8
-630	0.3	-130	0.7
-620	0.5	-120	0.7
-610	0.6	-110	0.6
-600	0.5	-100	0.6
-590	0.6	-90	0.6
-580	0.7	-80	0.6
-570	0.7	-70	0.6
-560	0.6	-60	0.6
-550	0.4	-50	0.6
-540	0.3	-40	0.5
-530	0.4	-30	0.5
-520	0.4	-20	0.4
-510	0.3	-10	0.3
-500	0.3	0	0.2
-490	0.3	10	0.2
-480	0.3	20	0.1
-470	0.2	30	0.1
-460	0.0	40	0.1
-450	-0.2	50	0.1
-440	-0.4	60	0.1
-430	-0.3	70	0.2
-420	-0.2	80	0.4
-410	-0.2	90	0.5
-400	-0.2	100	0.5
-390	-0.2	110	0.5
-380	-0.2	120	0.4
-370	-0.3	130	0.5
-360	-0.1	140	0.6
-350	0.1	150	0.7
-340	0.4	160	0.8
-330	0.4	170	0.8
-320	0.4	180	0.7
-310	0.2	190	0.7
-300	0.2	200	0.6
-290	0.2	210	0.6
-280	0.3	220	0.6
-270	0.5	230	0.7
-260	0.6	240	0.7
-250	0.5	250	0.8
-240	0.4	260	0.8
-230	0.4	270	0.8
-220	0.4	280	0.8
-210	0.4	290	0.8

**Vertical Crash Pulse (Event Record 2)
Normal Acceleration (SDM Recorded Vehicle Vertical Acceleration for Rollover
Event)**

Contains No Recorded Data

Pre-Crash Data -5.0 to -0.5 sec (Event Record 2)

Times (sec)	Accelerator Pedal, % Full (Accelerator Pedal Position)	Service Brake (Brake Switch Circuit State)	Engine RPM (Engine Speed)	Engine Throttle, % Full (Throttle Position)	Speed, Vehicle Indicated (Vehicle Speed) (MPH [km/h])
-5.0	43	Off	3072	39	33 [53]
-4.5	43	Off	3200	39	35 [56]
-4.0	41	Off	2880	38	35 [57]
-3.5	41	Off	2368	38	37 [60]
-3.0	41	Off	2432	41	39 [62]
-2.5	40	Off	2368	39	40 [64]
-2.0	39	Off	2368	39	41 [66]
-1.5	31	Off	2432	34	42 [68]
-1.0	29	Off	2368	35	42 [67]
-0.5	26	Off	1792	33	42 [68]

Pre-Crash Data -2.0 to -0.5 sec (Event Record 2)

Times (sec)	Cruise Control Active	Cruise Control Resume Switch Active	Cruise Control Set Switch Active	Engine Torque (lb-ft [N-m])	Reduced Engine Power Mode Indicator
-2.0	No	No	No	219 [298]	Off
-1.5	No	No	No	133 [180]	Off
-1.0	No	No	No	94 [128]	Off
-0.5	No	No	No	166 [224]	Off

System Status at Event (Event Record 3)

Event Record Type	Non-Deployment
OnStar Deployment Status Data Sent	Yes
Complete file recorded (Event Recording Complete)	Yes
Crash Record Locked	No
OnStar SDM Recorded Vehicle Velocity Change Data Sent	Yes
Deployment Event Counter	2
Multi-Event, Number of Events (Event Counter)	3
OnStar Notification Event Counter	3
Time From Event 1 to 2 (Time Between Events) (seconds)	3.12
Ignition Cycle, Crash (Ignition Cycles at Event)	9590
Algorithm Active: Frontal	Yes
Algorithm Active: Side	Yes
Algorithm Active: Rollover	Yes
Algorithm Active: Rear	Yes
Concurrent Event Flag Set	No
Event Severity Status: Frontal Pretensioner	No
Event Severity Status: Frontal Stage 1	No
Event Severity Status: Frontal Stage 2	No
Event Severity Status: Left Side	No
Event Severity Status: Right Side	No
Event Severity Status: Rear	No
Event Severity Status: Rollover	No
Safety Belt Status, Driver (Driver Belt Switch Circuit Status)	Buckled
Safety Belt Status, Right Front Passenger (Passenger Belt Switch Circuit Status)	Not Buckled
Center Front Row Belt Switch Circuit Status (If Equipped)	Data Not Available
Left Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Center Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Right Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Seat Track Position Switch, Foremost, Status, Driver (Driver Seat Position Status)	No (Rearward)
Seat Track Position Switch, Foremost, Status, Right Front Passenger (Passenger Seat Position Status)	No (Rearward)
Passenger Seat Occupancy Status	Empty
Occupant Size Right Front Passenger Child (Passenger Classification Status)	No (Not Applicable)
Passenger Air Bag ON Indicator Status	Off
Passenger Air Bag OFF Indicator Status	On
Low Tire Pressure Warning Lamp Status 0.5 Seconds Prior to Time Zero	Off
Frontal Air Bag Warning Lamp (SIR Warning Lamp Status 0.5 Seconds Prior to Time Zero)	On
SIR Warning Lamp ON/OFF Time Continuously (seconds)	0
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	0
Ignition Cycles Since DTCs Were Last Cleared 0.5 Seconds Prior to Time Zero	37
Maximum Delta-V, Longitudinal (Maximum Longitudinal SDM Recorded Vehicle Velocity Change for FSR Event) MPH [km/h]	-5 [-8]
Time, Maximum Delta-V (Time From FSR Time Zero to Maximum Longitudinal SDM Recorded Vehicle Velocity Change)(msec)	194
Maximum Delta-V, Lateral (Maximum Lateral SDM Recorded Vehicle Velocity Change for FSR Event) MPH [km/h]	12 [19]
Time Maximum Delta-V, Lateral (Time From FSR Time Zero to Maximum Lateral SDM Recorded Vehicle Velocity Change)(msec)	194
High Voltage Disable Notification Sent	Yes
Deployment Commanded in Energy Reserve Mode	No

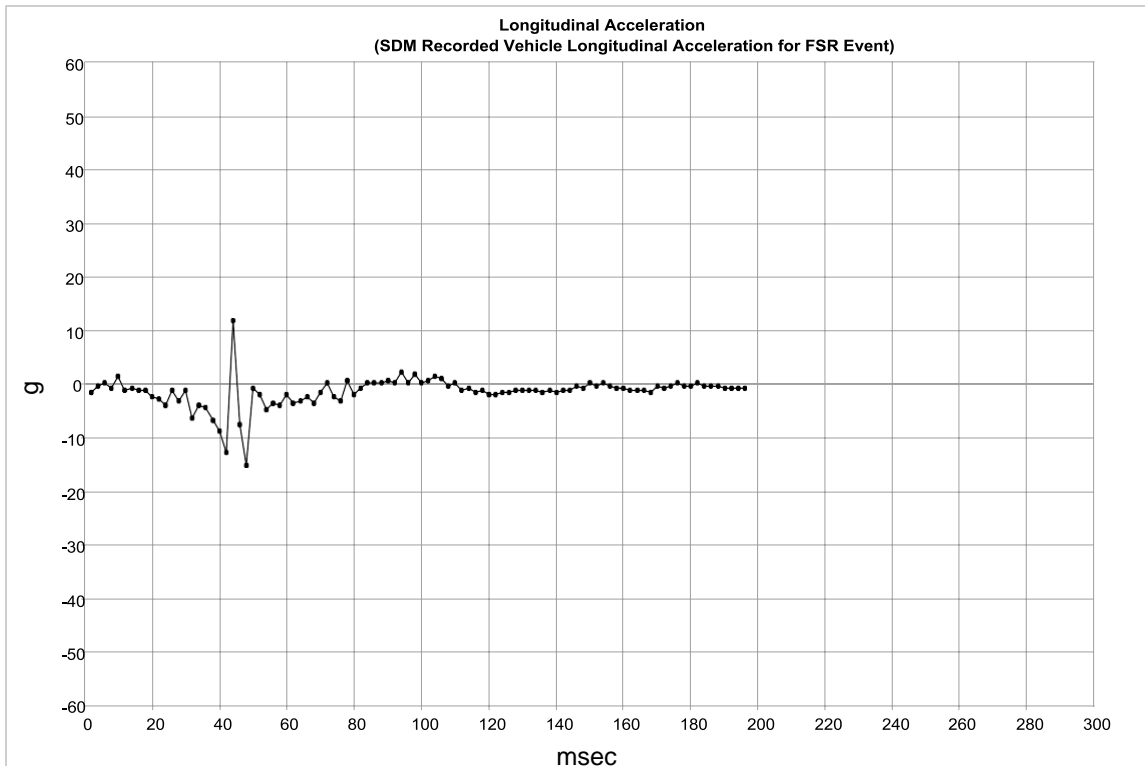
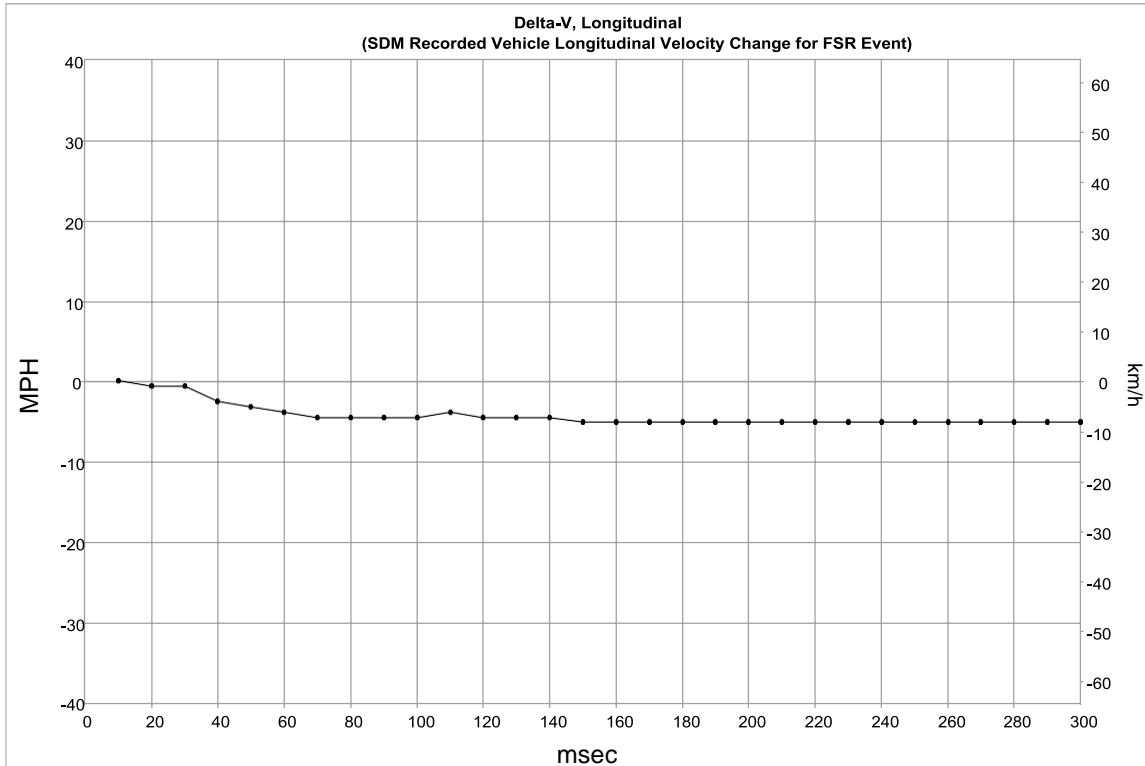
DTCs Present at Time of Event (Event Record 3)

B0052-00

Event Data (Event Record 3)

Driver 1st Stage Deployment Loop Commanded	No
Passenger 1st Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop #1 Commanded	No
Passenger Pretensioner Deployment Loop #1 Commanded	No
Driver Pretensioner Deployment Loop #2 Commanded	No
Passenger Pretensioner Deployment Loop #2 Commanded	No
Driver Thorax Loop Commanded	No
Passenger Thorax Loop Commanded	No
Left Row 1 Roof Rail/Head Curtain Loop Commanded	No
Right Row 1 Roof Rail/Head Curtain Loop Commanded	No
Frontal Air Bag Deployment, Time to 1st Stage Deployment, Driver (Driver 1st Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Frontal Air Bag Deployment, Time to 2nd Stage, Driver (Driver 2nd Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Frontal Air Bag Deployment, Time to 1st Stage Deployment, Right Front Passenger (Passenger 1st Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (Passenger 2nd Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Side air bag deployment, time to deploy, driver (Driver Thorax/Curtain Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Side air bag deployment, time to deploy, right front passenger (Passenger Thorax/Curtain Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Pretensioner Deployment, Time to Fire, Driver (Driver Pretensioner Time From Time Zero to Deployment Loop #1 or Loop #2 Command Criteria Met) (msec)	Data Not Available
Pretensioner Deployment, Time to Fire, Right Front Passenger (Passenger Pretensioner Time From Time Zero to Deployment Loop #1 or Loop #2 Command Criteria Met) (msec)	Data Not Available

Longitudinal Crash Pulse (Event Record 3)



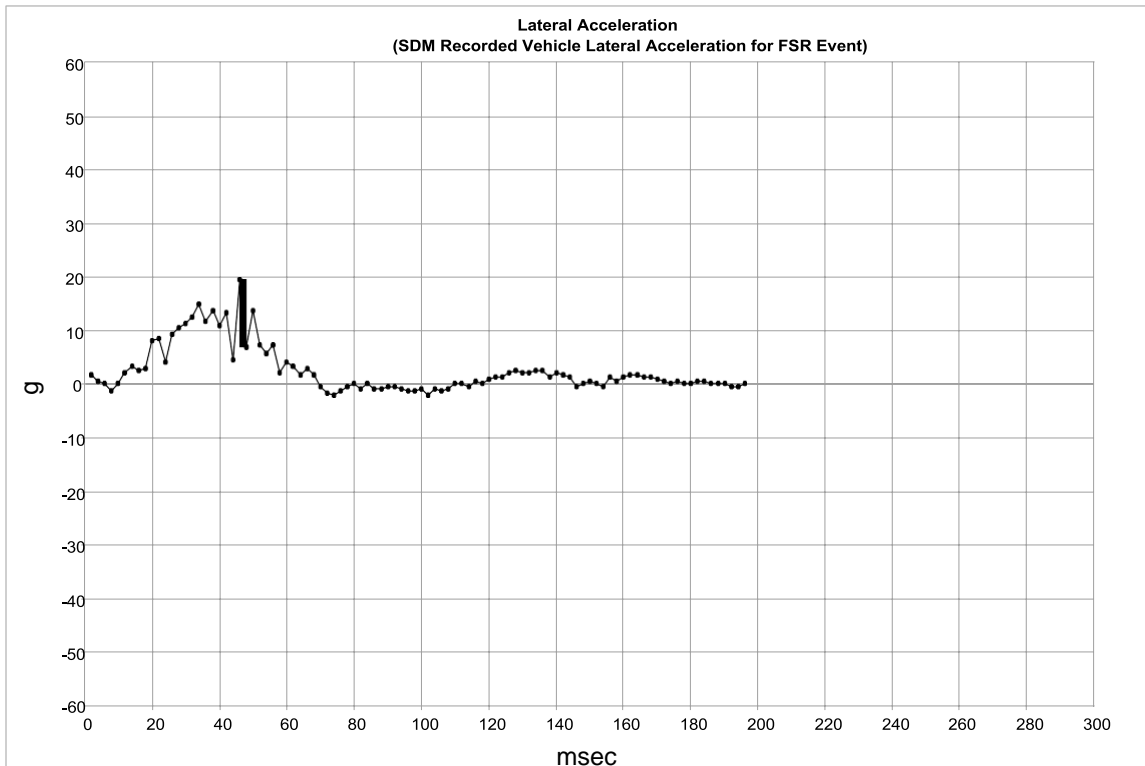
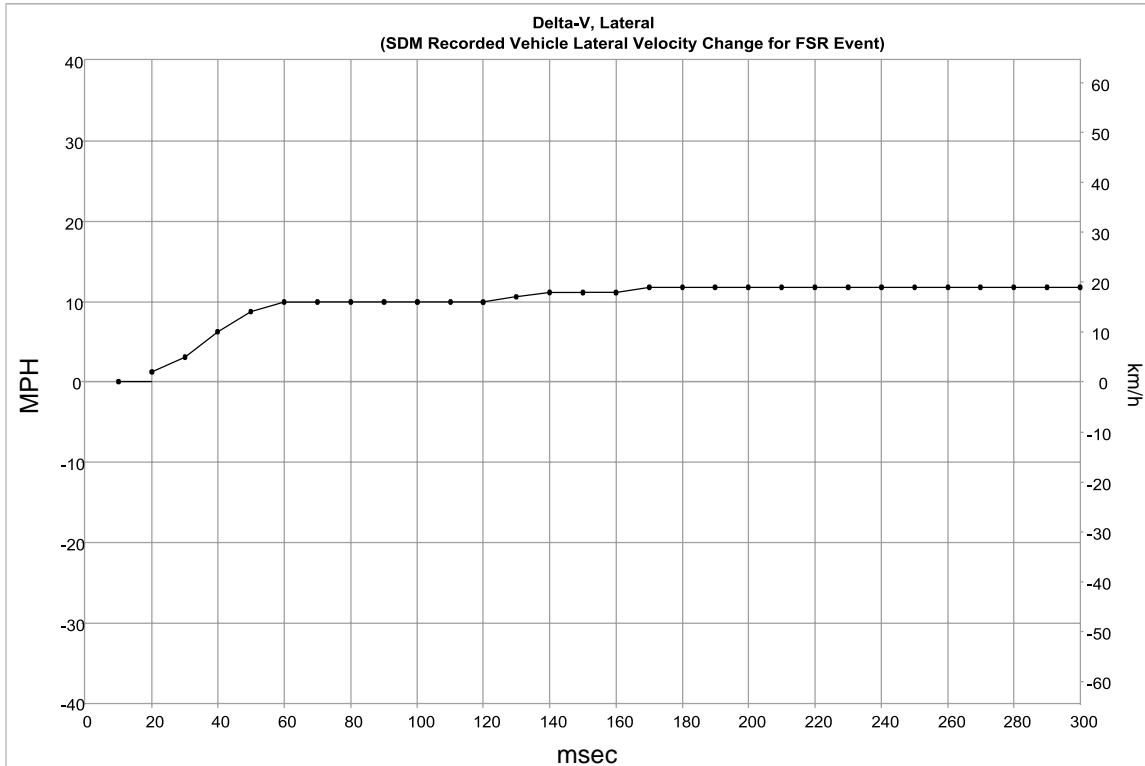
Longitudinal Crash Pulse (Event Record 3)

Time (msec)	Delta-V, Longitudinal (SDM Recorded Vehicle Longitudinal Velocity Change for FSR Event) (MPH)	Delta-V, Longitudinal (SDM Recorded Vehicle Longitudinal Velocity Change for FSR Event) (km/h)
10	0.0	0.0
20	-0.6	-1.0
30	-0.6	-1.0
40	-2.5	-4.0
50	-3.1	-5.0
60	-3.7	-6.0
70	-4.3	-7.0
80	-4.3	-7.0
90	-4.3	-7.0
100	-4.3	-7.0
110	-3.7	-6.0
120	-4.3	-7.0
130	-4.3	-7.0
140	-4.3	-7.0
150	-5.0	-8.0
160	-5.0	-8.0
170	-5.0	-8.0
180	-5.0	-8.0
190	-5.0	-8.0
200	-5.0	-8.0
210	-5.0	-8.0
220	-5.0	-8.0
230	-5.0	-8.0
240	-5.0	-8.0
250	-5.0	-8.0
260	-5.0	-8.0
270	-5.0	-8.0
280	-5.0	-8.0
290	-5.0	-8.0
300	-5.0	-8.0

Longitudinal Crash Pulse (Event Record 3)

Time (msec)	Longitudinal Acceleration (SDM Recorded Vehicle Longitudinal Acceleration for FSR Event) (g)	Time (msec)	Longitudinal Acceleration (SDM Recorded Vehicle Longitudinal Acceleration for FSR Event) (g)	Time (msec)	Longitudinal Acceleration (SDM Recorded Vehicle Longitudinal Acceleration for FSR Event) (g)
2	-1.4	102	0.6	202	Data Not Available
4	-0.2	104	1.4	204	Data Not Available
6	0.2	106	1.0	206	Data Not Available
8	-0.6	108	-0.2	208	Data Not Available
10	1.4	110	0.2	210	Data Not Available
12	-1.0	112	-1.0	212	Data Not Available
14	-0.6	114	-0.6	214	Data Not Available
16	-1.0	116	-1.4	216	Data Not Available
18	-1.0	118	-1.0	218	Data Not Available
20	-2.2	120	-1.8	220	Data Not Available
22	-2.6	122	-1.8	222	Data Not Available
24	-3.8	124	-1.4	224	Data Not Available
26	-1.0	126	-1.4	226	Data Not Available
28	-3.0	128	-1.0	228	Data Not Available
30	-1.0	130	-1.0	230	Data Not Available
32	-6.2	132	-1.0	232	Data Not Available
34	-3.8	134	-1.0	234	Data Not Available
36	-4.2	136	-1.4	236	Data Not Available
38	-6.6	138	-1.0	238	Data Not Available
40	-8.6	140	-1.4	240	Data Not Available
42	-12.6	142	-1.0	242	Data Not Available
44	11.8	144	-1.0	244	Data Not Available
46	-7.4	146	-0.2	246	Data Not Available
48	-15.0	148	-0.6	248	Data Not Available
50	-0.6	150	0.2	250	Data Not Available
52	-1.8	152	-0.2	252	Data Not Available
54	-4.6	154	0.2	254	Data Not Available
56	-3.4	156	-0.2	256	Data Not Available
58	-3.8	158	-0.6	258	Data Not Available
60	-1.8	160	-0.6	260	Data Not Available
62	-3.4	162	-1.0	262	Data Not Available
64	-3.0	164	-1.0	264	Data Not Available
66	-2.2	166	-1.0	266	Data Not Available
68	-3.4	168	-1.4	268	Data Not Available
70	-1.4	170	-0.2	270	Data Not Available
72	0.2	172	-0.6	272	Data Not Available
74	-2.2	174	-0.2	274	Data Not Available
76	-3.0	176	0.2	276	Data Not Available
78	0.6	178	-0.2	278	Data Not Available
80	-1.8	180	-0.2	280	Data Not Available
82	-0.6	182	0.2	282	Data Not Available
84	0.2	184	-0.2	284	Data Not Available
86	0.2	186	-0.2	286	Data Not Available
88	0.2	188	-0.2	288	Data Not Available
90	0.6	190	-0.6	290	Data Not Available
92	0.2	192	-0.6	292	Data Not Available
94	2.2	194	-0.6	294	Data Not Available
96	0.2	196	-0.6	296	Data Not Available
98	1.8	198	Data Not Available	298	Data Not Available
100	0.2	200	Data Not Available	300	Data Not Available

Lateral Crash Pulse (Event Record 3)



Lateral Crash Pulse (Event Record 3)

Time (msec)	Delta-V, Lateral (SDM Recorded Vehicle Lateral Velocity Change for FSR Event) (MPH)	Delta-V, Lateral (SDM Recorded Vehicle Lateral Velocity Change for FSR Event) (km/h)
10	0.0	0.0
20	1.2	2.0
30	3.1	5.0
40	6.2	10.0
50	8.7	14.0
60	9.9	16.0
70	9.9	16.0
80	9.9	16.0
90	9.9	16.0
100	9.9	16.0
110	9.9	16.0
120	9.9	16.0
130	10.6	17.0
140	11.2	18.0
150	11.2	18.0
160	11.2	18.0
170	11.8	19.0
180	11.8	19.0
190	11.8	19.0
200	11.8	19.0
210	11.8	19.0
220	11.8	19.0
230	11.8	19.0
240	11.8	19.0
250	11.8	19.0
260	11.8	19.0
270	11.8	19.0
280	11.8	19.0
290	11.8	19.0
300	11.8	19.0

Lateral Crash Pulse (Event Record 3)

Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for FSR Event) (g)	Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for FSR Event) (g)	Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for FSR Event) (g)
2	1.8	102	-1.8	202	Data Not Available
4	0.6	104	-0.6	204	Data Not Available
6	0.2	106	-1.0	206	Data Not Available
8	-1.0	108	-0.6	208	Data Not Available
10	0.2	110	0.2	210	Data Not Available
12	2.2	112	0.2	212	Data Not Available
14	3.4	114	-0.2	214	Data Not Available
16	2.6	116	0.6	216	Data Not Available
18	3.0	118	0.2	218	Data Not Available
20	8.2	120	1.0	220	Data Not Available
22	8.6	122	1.4	222	Data Not Available
24	4.2	124	1.4	224	Data Not Available
26	9.4	126	2.2	226	Data Not Available
28	10.6	128	2.6	228	Data Not Available
30	11.4	130	2.2	230	Data Not Available
32	12.6	132	2.2	232	Data Not Available
34	15.0	134	2.6	234	Data Not Available
36	11.8	136	2.6	236	Data Not Available
38	13.8	138	1.4	238	Data Not Available
40	11.0	140	2.2	240	Data Not Available
42	13.4	142	1.8	242	Data Not Available
44	4.6	144	1.4	244	Data Not Available
46	19.4	146	-0.2	246	Data Not Available
48	7.0	148	0.2	248	Data Not Available
50	13.8	150	0.6	250	Data Not Available
52	7.4	152	0.2	252	Data Not Available
54	5.8	154	-0.2	254	Data Not Available
56	7.4	156	1.4	256	Data Not Available
58	2.2	158	0.6	258	Data Not Available
60	4.2	160	1.4	260	Data Not Available
62	3.4	162	1.8	262	Data Not Available
64	1.8	164	1.8	264	Data Not Available
66	3.0	166	1.4	266	Data Not Available
68	1.8	168	1.4	268	Data Not Available
70	-0.2	170	1.0	270	Data Not Available
72	-1.4	172	0.6	272	Data Not Available
74	-1.8	174	0.2	274	Data Not Available
76	-1.0	176	0.6	276	Data Not Available
78	-0.2	178	0.2	278	Data Not Available
80	0.2	180	0.2	280	Data Not Available
82	-0.6	182	0.6	282	Data Not Available
84	0.2	184	0.6	284	Data Not Available
86	-0.6	186	0.2	286	Data Not Available
88	-0.6	188	0.2	288	Data Not Available
90	-0.2	190	0.2	290	Data Not Available
92	-0.2	192	-0.2	292	Data Not Available
94	-0.6	194	-0.2	294	Data Not Available
96	-1.0	196	0.2	296	Data Not Available
98	-1.0	198	Data Not Available	298	Data Not Available
100	-0.6	200	Data Not Available	300	Data Not Available

**Rollover Crash Pulse (Event Record 3)
SDM Recorded Vehicle Roll Rate**

Contains No Recorded Data

**Rollover Crash Pulse (Event Record 3)
Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for Rollover
Event)**

Contains No Recorded Data

**Vertical Crash Pulse (Event Record 3)
Normal Acceleration (SDM Recorded Vehicle Vertical Acceleration for Rollover
Event)**

Contains No Recorded Data

Pre-Crash Data -5.0 to -0.5 sec (Event Record 3)

Times (sec)	Accelerator Pedal, % Full (Accelerator Pedal Position)	Service Brake (Brake Switch Circuit State)	Engine RPM (Engine Speed)	Engine Throttle, % Full (Throttle Position)	Speed, Vehicle Indicated (Vehicle Speed) (MPH [km/h])
-5.0	39	Off	2368	39	41 [66]
-4.5	31	Off	2432	34	42 [68]
-4.0	29	Off	2368	35	42 [67]
-3.5	23	Off	1792	31	42 [67]
-3.0	20	Off	1792	60	40 [65]
-2.5	82	Off	1856	45	40 [65]
-2.0	99	Off	3136	34	35 [56]
-1.5	72	Off	2560	36	27 [44]
-1.0	94	Off	2752	18	32 [51]
-0.5	60	Off	2560	20	29 [47]

Pre-Crash Data -2.0 to -0.5 sec (Event Record 3)

Times (sec)	Cruise Control Active	Cruise Control Resume Switch Active	Cruise Control Set Switch Active	Engine Torque (lb-ft [N-m])	Reduced Engine Power Mode Indicator
-2.0	No	No	No	89 [121]	Off
-1.5	No	No	No	129 [175]	Off
-1.0	No	No	No	-5 [-7]	Off
-0.5	No	No	No	-13 [-18]	Off

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August 2020



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

