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CALSPAN ON-SITE ELECTRIC VEHICLE CRASH INVESTIGATION

SCI CASE NO.: CA11015

VEHICLE: 2011 CHEVROLET VOLT

LOCATION: NEW YORK

CRASH DATE: APRIL 2011

Contract No. DTNH22-07-C-00043

Prepared for:

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points are coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract This on-site investigation focused on the 2011 Chevrolet Volt electric vehicle. The front of the Chevrolet Volt was involved in an intersection crash with the left side of a 2007 Chevrolet Silverado K2500 pickup truck. After initial impact, the vehicles were redirected to the southeast corner of the intersection. The left side of the Chevrolet Volt contacted the left side of the Chevrolet K2500. Both vehicles then departed the southeast intersection quadrant before coming to rest. The crash resulted in the deployment of the Chevrolet Volt's Certified Advanced 208-Compliant (CAC) driver air bag, driver knee bolster air bag, driver seatback-mounted side air bag, and both Inflatable-Curtain (IC) air bags. The 54-year-old female driver of the Chevrolet Volt was transported via ground ambulance to a local hospital for the treatment of minor injuries. Occupants of the Chevrolet K2500 pickup included an 84-year-old male driver, a 33-year-old male front right passenger, and a 26-year-old male seated in the second row right position. None of the Chevrolet K2500's occupants was injured in the crash.			
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BACKGROUND

This on-site investigation focused on the 2011 Chevrolet Volt electric vehicle (**Figure 1**). The Chevrolet Volt was involved in an intersection crash with a 2007 Chevrolet Silverado K2500 pickup truck. The crash was identified by the Crash Investigation Division (CID) of the National Highway Traffic Safety Administration (NHTSA), and forwarded to the Calspan Special Crash Investigations (SCI) team for follow-up on May 13, 2011. The Calspan SCI team initiated contact with the insurance adjuster and established cooperation to inspect the vehicle on May 19, 2011. The Chevrolet Volt had been considered a total loss and was located in an insurance salvage facility. The Chevrolet K2500 had been repaired by the time of case notification, and was back in service. The on-site portion of the investigation was conducted on May 20, 2011, and consisted of the detailed inspection and documentation of the involved vehicles, the imaging of both vehicles' Event Data Recorders (EDRs), the interview of a surrogate of the driver of the Chevrolet Volt, and the inspection and documentation of the crash site.

Figure 1: Front/left oblique view of the Chevrolet Volt.

The crash resulted in the deployment of the Chevrolet Volt's Certified Advanced 208-Compliant (CAC) driver air bag, driver knee bolster air bag, driver seatback-mounted side impact air bag, and both Inflatable-Curtain (IC) air bags. The 54-year-old female driver of the Chevrolet Volt was transported via ground ambulance to a local hospital for the treatment of minor injuries. Occupants of the Chevrolet K2500 pickup included an 84-year-old male driver, a 33-year-old male front right passenger, and a 26-year-old male seated in the second row right position. None of the Chevrolet K2500's occupants was injured in the crash.

CRASH SUMMARY

Crash Site

The crash occurred at the four-leg intersection of two-lane roadways. The north and south legs of the intersection were controlled by stop signs, while the east and west legs were uncontrolled. The asphalt (bituminous) roadways were straight and level in both vehicles' travel directions. The land bordering the south and east legs of the intersection formed the landscaped lawn of a local residence.

The Chevrolet Volt was eastbound on approach to the intersection, as depicted in **Figure 2**. Both travel lanes were 3.6 m (12 ft) wide. They were delineated by a double-solid yellow centerline and solid white fog lines with 1.2 m (4 ft) wide shoulders. Speed in the eastbound travel direction of the Chevrolet Volt was regulated by a posted limit of 72 km/h (45 mph). A drainage ditch extended parallel to the east/west roadway on both sides of the intersection, centered 3.4 m (11 ft) south of the roadway edge.

Figure 2: Eastbound trajectory view of the Chevrolet Volt.

The Chevrolet K2500 pickup truck was traveling in the 6.5 m (21 ft) wide southbound lane of the north intersecting leg, which was delineated from the 3.4 m (11 ft) wide northbound lane by a double-solid yellow centerline. Speed was regulated by a posted limit of 89 km/h (55 mph). A Scene Diagram is included on page 18 of this report.

Pre-Crash

According to local weather reports, weather conditions in the locality of the crash were cloudy with an ambient temperature of 10 Celsius (50 Fahrenheit) degrees. The Chevrolet K2500 pickup truck was traveling southbound on the dry asphalt road surface, approaching the intersection. The driver slowed the vehicle in response to the stop sign controlling the intersection for his corresponding direction of travel. He intended to proceed through the intersection and maintain southbound travel. According to data imaged from the vehicle's EDR, the Chevrolet K2500 was traveling 13 km/h (8 mph) at a time five seconds prior to the Algorithm Enable (AE). The EDR further reported that the vehicle's brake switch status was "ON" both at -5 and -4 seconds, but was "OFF" from -3 to -1 second. In correspondence to the reported brake switch status, the EDR reported vehicle speed had diminished to 3 km/h (2 mph) at -3 seconds, then increased to 18 km/h (11 mph) at -1 second.

The Chevrolet Volt was westbound on approach to the same intersection. The driver was intending on proceeding straight, as the intersection was not controlled in her corresponding direction of travel. According to pre-crash data imaged from the vehicle's EDR, the Chevrolet Volt was traveling 76 km/h (47 mph) at a time 2.5-seconds prior to the AE. The brake switch status was reported "ON" beginning at -1.0 seconds, reducing vehicle speed to 48 km/h (30 mph) at -0.5 seconds. The driver of the Chevrolet Volt was braking and steering right in an attempt to avoid the crash. Brake switch status data imaged from the EDR, coupled with evidence at scene and the physical dynamics of the crash, confirmed this avoidance braking and steering action by the driver of the Chevrolet Volt.

Crash

The first event occurred when the front plane of the Chevrolet Volt impacted the forward aspect of the right side of the Chevrolet K2500 pickup truck in an L-shaped configuration. This configuration was evidenced by the 43 cm (17 in) diameter circular imprint of the Chevrolet K2500's right front wheel on the left aspect of the front bumper cover of the Chevrolet Volt. Resultant directions of force were within the 11 o'clock sector for the Chevrolet Volt and the 2 o'clock sector for the Chevrolet K2500. This impact resulted in the actuation of the Chevrolet Volt's safety belt pretensioners, the deployment of the driver's CAC frontal air bag, and the deployment of the driver's knee bolster air bag.

As the two vehicles engaged, the Chevrolet Volt initiated a clockwise (CW) rotation and the Chevrolet K2500 rotated counterclockwise (CCW). Although both vehicles maintained their forward movement, their trajectories were redirected toward the southeast corner of the intersection. These dynamics resulted in a second event, wherein the rear aspect of the left plane of the Chevrolet Volt contacted the rear aspect of the right plane of the Chevrolet K2500 in a side-slap configuration. The corresponding resultant directions of force were within the 9 o'clock sector for the Chevrolet Volt and the 3 o'clock sector for the Chevrolet K2500. This event resulted in the deployment of the Chevrolet Volt's side impact/rollover IC air bags and front left seatback-mounted side impact air bag.

After the second impact event, the two vehicles separated. The Chevrolet Volt maintained its trajectory and departed the southeast corner of the intersection, entering the lawn of a residence. It continued through the lawn for 25 m (82 ft) in a slight CW arc before coming to rest on the lawn, facing south. The Chevrolet Volt's trajectory and final rest position were evidenced by faint rolling tire marks in the soft soil of the lawn and an area of grass that had turned brown from leaking vehicular fluids.

The Chevrolet K2500 maintained its redirected trajectory and departed the southeast corner of the intersection. It contacted the ground with its undercarriage (Event 3) as it traversed the roadside ditch and entered the lawn of the residence. The Chevrolet K2500 maintained forward movement for 19 m (62 ft) in a slight CCW arc before coming to rest on the lawn, facing east. The Chevrolet K2500's trajectory and final rest position were evidenced by distinct rolling tire marks through the soft soil of the lawn.

Post-Crash

The emergency response system was notified of the crash and subsequently dispatched local police department, fire department, and ambulance personnel to the scene. First arriving emergency services personnel found the driver of the Chevrolet Volt complaining of neck pain. She was assisted from the vehicle and transported via ground ambulance to a local hospital for evaluation. All three occupants of the Chevrolet K2500 pickup truck were ambulatory at the scene and uninjured.

Both vehicles were towed from scene. The Chevrolet Volt was removed by the insurance company to a regional salvage facility where it was held for SCI inspection. The Chevrolet K2500 pickup truck was repaired by the owner prior to SCI case assignment and placed back in service.

2011 CHEVROLET VOLT

Description

The 2011 Chevrolet Volt was manufactured in January 2011 and identified by the Vehicle Identification Number (VIN): 1G1RC6E49BU xxxxxx. Vehicle mileage at the time of SCI inspection was unknown because the electrical systems of the Chevrolet Volt were disabled. The Chevrolet Volt (**Figure 3**) was propelled exclusively by electric motors. Its primary source of energy was a 360-V, 16 kWh lithium-ion battery. In the event that this battery became depleted, a 1.4 L inline 4-cylinder internal combustion engine generated supplemental energy. The front-wheel drive Chevrolet Volt utilized an automatic 4ET50 transmission. The vehicle had a 269 cm (105.7 in) wheelbase with a Gross Vehicle Weight Rating (GVWR) of 2,060 kg (4,542 lb). The front and rear Gross Axle Weight Ratings (GAWR) were 1,139 kg (2,511 lb) and 922 kg (2,033 lb), respectively. The manufacturer's recommended tire size was P215/55R17 front and rear, with cold pressures of 241 kPa (35 PSI). At the time of SCI inspection, the vehicle was equipped with Goodyear Assurance tires of the recommended size and with matching Tire Identification Numbers (TIN) at all four axle positions. Specific tire data was as follows:

Figure 3: Right front oblique view of the Chevrolet Volt.

Position	Measured Pressure	Measured Tread Depth	Restriction	Damage
LF	234 kPa (34 PSI)	6 mm (8/32 in)	NO	NONE
LR	241 kPa (35 PSI)	7 mm (9/32 in)	NO	NONE
RR	241 kPa (35 PSI)	6 mm (8/32 in)	NO	NONE
RF	238 kPa (34.5 PSI)	6 mm (8/32 in)	NO	NONE

The interior of the Chevrolet Volt was configured for the seating of four occupants. There were two rows of two forward-facing cloth bucket seats, with an open rear cargo area. A center console spanned the center of the vehicle from the front instrument panel to the rear cargo area. The floor of the rear cargo area could be folded up to gain access to the low-voltage (12 V) battery and tire repair kit.

Exterior Damage

The front of the Chevrolet Volt sustained moderate damage as a result of the frontal impact with the Chevrolet K2500. Direct damage began at the front left bumper corner and extended 86 cm (33.8 in) to the right, while the induced damage extended the full 168 cm (66.3 in) undeformed end width from bumper corner-to-bumper corner. Direct damage included a 43 cm (17 in) diameter circular imprint of the Chevrolet K2500's right front wheel on the front left corner of the front bumper fascia. The front bumper was crushed rearward and displaced right laterally. Both headlamp assemblies were disintegrated. The hood displayed an arching area of deformation biased to the front left aspect, as depicted in **Figure 4**. Frontal components were crushed longitudinally and laterally, resulting in the induced displacement to underhood components. The front bumper reinforcement bar and frame mounts were displaced right laterally 8 cm (3 in). A residual crush profile with Field-L width of 112 cm (44 in) documented at the bumper reinforcement bar and the radiator support beam produced the following averaged measurements: C1 = 19 cm (7.5 in), C2 = 17 cm (6.8 in), C3 = 21 cm (8.3 in), C4 = 15 cm (6 in), C5 = 7 cm (2.8 in), and C6 = 10 cm (4 in). The Collision Deformation Classification (CDC) associated with the damage pattern to the Chevrolet Volt from Event 1 was 11FYEW1.

Figure 4: Front impact damage to the Chevrolet Volt.

Damage from the second event was located on the left side aft of the B-pillar (**Figure 5**). The direct damage extended 130 cm (51 in) forward from the left rear bumper corner and consisted of minor surface scratches, abrasions, and body deformation. The exterior lens of the left rear taillight assembly was fractured, and there was slight crush to the lower aspect of the exterior skin of the left rear door. The induced damage length measured 170 cm (67 in) from the left rear bumper corner forward to the B-pillar. The CDC corresponding to the damage from Event 2 was 09LZAW1.

Figure 5: Side-slap damage to the Chevrolet Volt.

Event Data Recorder

The Chevrolet Volt was equipped with an air bag Sensing and Diagnostic Module (SDM) mounted under the center console. The SDM had EDR capabilities to record two different event types, termed "Non-Deployment" and "Deployment". The SDM could store a combination of up to three deployment or locked non-deployment events. Non-deployment events could be overwritten after 250 ignition cycles, whereas deployment events could not be overwritten. Associated to each respective event was a 2.5-second pre-crash buffer that recorded Accelerator Pedal Position, Brake Switch Circuit State, Engine Speed (RPM), Throttle Position (%), and Vehicle Speed data. For the 0.5 and 1-second pre-crash intervals, the EDR also recorded Cruise Control use, Engine Torque, and Reduced Engine Power Mode. The EDR monitored and measured vehicle acceleration in both the longitudinal and lateral direction, and the recording of each distinct crash event could be triggered by a frontal (longitudinal), a side (lateral), and/or a rollover (vertical) crash pulse with a measured Vehicle Velocity Change greater than 8 km/h (5 mph). Upon Algorithm Enable (AE) and recognition of a longitudinal or lateral event, the EDR had the capacity to record 70 milliseconds of pre-AE and 220 of milliseconds post-AE longitudinal and lateral delta-V data in 10 millisecond intervals. If the EDR recognized a rollover event, it could record 490 milliseconds of pre-AE and 250 milliseconds of post-AE lateral acceleration, vertical acceleration, and vehicle roll rate (degrees per second) in 10 millisecond intervals.

The data from the Chevrolet Volt's EDR was imaged using the Bosch Crash Data Retrieval Tool software version 3.8, via the Diagnostic Link Connector (DLC). The EDR data imaged from the Chevrolet Volt had two distinct stored events. Both were termed "Deployment" and were related to the subject crash. They also occurred on the same ignition counter number of 389, with an EDR reported time between the two events of 0.53 seconds. The EDR reported complete event recording for both events and identified them as "Event Record 1" and "Event Record 2", and each contained eight pages linked by a field within the data sets. Data for both events reported that the Driver Belt Switch Circuit Status was "Buckled" and the Passenger Seat Occupancy Status was "Empty". Both events also reported Battery Cutoff Loop Commanded "YES".

The first trigger after AE was recorded as a frontal (longitudinal) event at zero milliseconds, corresponding to Event 1 of the subject crash. This data set was labeled "Event Record 1", and had the following recorded pre-crash buffer data:

Time (seconds)	-2.5	-2	-1.5	-1	-0.5
Vehicle Speed	76 km/h (47 mph)	75 km/h (47 mph)	75 km/h (47 mph)	73 km/h (45 mph)	48 km/h (30 mph)
Brake Switch Circuit Status	OFF	OFF	OFF	ON	ON
Accelerator Pedal Position	15%	15%	8%	0%	0%
Throttle Position	21%	21%	21%	21%	21%
Engine Speed	0 RPM	0 RPM	0 RPM	0 RPM	0 RPM
Cruise Control Active	-	-	-	OFF	OFF
Engine Torque	-	-	-	-32 N-m (-24 lb-ft)	-32 N-m (-24 lb-ft)
Reduced Engine Power Mode	-	-	-	OFF	OFF

The throttle position and engine speed data of the SDM's pre-crash buffer confirm that the Chevrolet Volt was operating on its high-voltage electric motor at the time of the crash. SDM data for "Event Record 1" reported that the Driver First Stage Time From AE to Deployment Command was 36 milliseconds, while the Second Stage Time was at 156 milliseconds. The time from AE to deployment loop was 6 milliseconds for both the driver and passenger pretensioners. The Maximum SDM Recorded Vehicle Velocity Change (delta-V) occurred at 110 milliseconds after AE and had longitudinal and lateral components of -24 km/h (-14.9 mph) and 10 km/h (6 mph), respectively. The Rollover Algorithm was not enabled.

The second trigger recorded as a left side (lateral) event at 0.53 seconds after AE, corresponding to Event 2 of the subject crash. This data set was labeled "Event Record 2", and had the following recorded pre-crash buffer data:

Time (seconds)	-2.5	-2	-1.5	-1	-0.5
Vehicle Speed	75 km/h (47 mph)	75 km/h (47 mph)	73 km/h (45 mph)	48 km/h (30 mph)	42 km/h (26 mph)
Brake Switch Circuit Status	OFF	OFF	ON	ON	ON
Accelerator Pedal Position	15%	8%	0%	0%	0%
Throttle Position	21%	21%	21%	21%	21%
Engine Speed	0 RPM	0 RPM	0 RPM	0 RPM	0 RPM
Cruise Control Active	-	-	-	OFF	OFF
Engine Torque	-	-	-	-32 N-m (-24 lb-ft)	-32 N-m (-24 lb-ft)
Reduced Engine Power Mode	-	-	-	OFF	OFF

Data for "Event Record 2" indicated a Driver Thorax/Curtain Time From AE to Deployment Command of 9 milliseconds. The Maximum SDM Recorded Vehicle Velocity Change (delta-V) occurred at 50 milliseconds after AE, with longitudinal and lateral components of 2 km/h (1 mph) and 5 km/h (3 mph), respectively. The Rollover Algorithm was not enabled. The imaged SDM data is included at the end of this technical report as **Attachment A**.

Interior Damage

There was no damage or intrusion of components within the interior of the Chevrolet Volt. All glazing remained intact and devoid of impact damage or occupant contact. All doors remained closed and operational.

Manual Restraint Systems

The Chevrolet Volt was equipped with manual 3-point lap and shoulder safety belts for all four seating positions. All four safety belts incorporated continuous loop webbing with sliding latch plates, and were absent of shoulder anchor height adjustments. The driver's safety belt system was equipped with an Emergency Locking Retractor (ELR), a retractor pretensioner, and a lower anchor pretensioner. The front right belt system was equipped with an ELR/Automatic Locking Retractor (ALR), a retractor pretensioner, and a lower anchor pretensioner. The two rear safety belts were equipped with switchable ELR/ALR retractors.

Loading abrasions were identified on the driver's seat belt webbing during the SCI inspection. These were located 80 cm (31.5 in) from the D-ring anchor point, and 58 cm (23 in) above the lower anchor (**Figure 6**). Both the retractor pretensioner and the lower anchor pretensioner were actuated. The lower anchor pretensioner was compressed 8 cm (3.1 in), based on an exemplar comparison. The front right safety belt was retracted taut against the B-pillar by the actuation of the retractor and lower anchor pretensioners, which indicated that the belt was not utilized at the time of the crash. Both rear belts were loosely retracted and neither displayed evidence of loading or historical wear.

Figure 6: Driver's safety belt.

Supplemental Restraint Systems

The Chevrolet Volt was equipped with eight air bags for supplemental restraint. Protection for the driver and front right passenger each included a CAC frontal air bag, knee bolster air bag, seatback-mounted side impact air bag, and IC air bag. The rollover sensing IC air bags extended along both roof side rails and also provided protection for both rear seating positions.

The frontal air bag system consisted of dual-stage air bags mounted in the steering wheel hub and top right instrument panel and single-stage knee bolster air bags mounted in the left and right lower instrument panels. It also incorporated safety belt buckle switches and a front right occupant weight sensor. The manufacturer of the Chevrolet Volt has certified that vehicle's frontal air bags were compliant to the advanced air bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The steering wheel hub and knee bolster air bags deployed during the crash, while the open front right occupant presence circuit prevented deployment command for both front right air bags.

The steering wheel hub-mounted air bag deployed through the I-configuration cover flaps of the module without damage. It was circular in shape with an overall diameter of 66 cm (26 in), and had a 15 cm (6 in) diameter double seam stitched in a circular fashion around the center (**Figure 7**). An area of vomit extended from the center stitching toward the lower left quadrant on the face of the bag. There were two vents on the rear of the bag, evenly spaced on either side of the following alphanumeric nomenclature at the upper aspect of the bag:

GMDELTAFLEXDAB
2426312 AE
01 14 11
S

The left lower instrument panel knee bolster air bag deployed through a 30 cm (11.8 in) long by 3 cm (1.2 in) wide slot. The deployed bag was nearly rectangular in shape and had an overall length

and width of 60 cm (23.6 in) and 30 cm (11.8 in), respectively. There were two horseshoe-shaped sections of stitching in the bag (**Figure 8**). A scuff was centered 22 cm (8.7 in) from the left edge and 12 cm (4.7 in) from the top of the bag, and was attributed to contact from the driver's left knee. There were no vents. On the back of the bag was the following alphanumeric sequence:

Figure 7: Deployed CAC driver air bag.

GM E FLEX KAB
2434638 AA
17 12 10
S

Figure 8: Deployed driver knee bolster air bag.

Side-impact protection within the Chevrolet Volt incorporated IC air bags and front seatback-mounted side air bags. Both IC air bags deployed during the crash, along with the left seatback-mounted side air bag. The left seatback air bag deployed from the module through 20 cm (8 in) of the outboard stitching of the seatback. The distance from the seat bight to the top of the air bag module measured 40 cm (15.8 in). In its deployed state, the air bag was rectangular in shape with an overall height of 65 cm (25.6 in) and an overall width of 26 cm (10.2 in). There were two vents on the forward aspect of the air bag. The upper vent was 8 cm (3.2 in) in height and began 15 cm (5.9 in) from the top of the air bag. The second vent was 3 cm (1.1 in) in height and began 16 cm (6.3 in) below the first vent. There was no alphanumeric nomenclature found on the air bag, nor was any contact evidence or damage present.

Figure 9: Deployed left seatback air bag.

The left and right IC air bags deployed through the headliner from the module mounted to the roof side rail. Mirror images of each other, the air bags were oval in shape with a respective overall length and height of 194 cm (76.4 in) and 40 cm (15.8 in). The air bags provided 75 cm (29.5 in) of coverage from the B-pillar forward for the front row occupants, with a 29 cm (11.4 in) sail panel that incorporated an A-pillar tether anchor. There was 90 cm (35.5 in) of coverage between the B- and C-pillars, with a ribbed pattern of non-fill seams in the center aspect of the coverage.

Figure 10: Front row coverage of the deployed right IC air bag.

Figure 11: Rear row coverage of the deployed right IC air bag.

It should be noted that the forward aspect of the left IC and the forward tether of the right IC were cut by emergency response personnel post-crash. However, both bags were devoid of contact evidence or crash-related damage. **Figure 10** and **Figure 11** provide views of the front and rear row coverage of the IC air bags. The IC air bags were stamped with the following alphanumeric nomenclature: *34081665 3 90789 D*

Extended Range Electric Vehicle

The Chevrolet Volt was an Extended Range Electric Vehicle (EREV) propelled exclusively by a Voltec electric powertrain. The entire system was comprised of a high-voltage electrical system, power inverter module, accessory power module, low-voltage electrical system, internal combustion generator, automatic transmission, and high-voltage battery charger. An overall view of the under-hood powertrain components of an exemplar Chevrolet Volt is depicted in **Figure 12**.

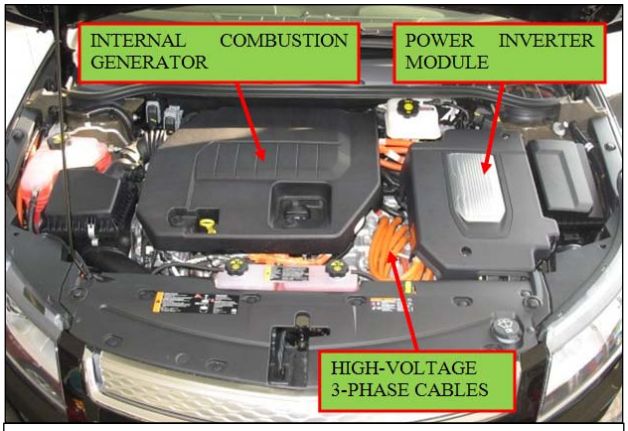


Figure 12: Powertrain components of an exemplar Chevrolet Volt.

According to the vehicle manufacturer, the powertrain was controlled by a fully automatic, variable-speed and electronically controlled 4ET50 transmission with front-wheel drive transaxle. It contained two electric motors powered by either the primary high-voltage electrical system or the secondary internal combustion generator. The electric motors were used to propel the vehicle, generate electrical energy, and control the supplemental internal combustion generator. According to vehicle manufacturer specifications, the Chevrolet Volt's Voltec electric powertrain was capable of 149 hp (111 kW) motoring power or 74 hp (55 kW) generating power. The 1.4 L inline 4-cylinder internal combustion generator was rated to produce 83 hp (62 kW).

The core of the Chevrolet Volt's high-voltage system was its lithium-ion battery pack. According to the vehicle manufacturer, this rechargeable battery consisted of 288 lithium-ion cells that could produce direct current (DC) at 360-V, and was rated at 16 kWh. The large T-shaped battery pack was mounted to the vehicle's undercarriage and spanned the longitudinal center area of the vehicle's two seating rows. There was a Manual Service Disconnect (MSD) plug located inside the storage compartment within the armrest of the first row center console (**Figure 13**). Removal of the MSD disabled the high-voltage system for maintenance or service. Internal to the battery pack was a network of high-voltage contactors that controlled the cells' direct current (DC) output. A power inverter module located on the left side of the powertrain compartment converted the high-voltage DC provided by the battery pack into the 3-phase alternating current (AC) used by the transmission. An accessory power module was located beneath the floor of the rear cargo area, and served to convert the high-voltage DC into the low-voltage DC used by vehicle accessories.

Figure 13: High-voltage MSD plug and receptacle (*partially removed*).

The Chevrolet Volt's low-voltage electrical system consisted of a 12-V Absorbent Glass Mat (AGM) battery located beneath the floor within the rear cargo area of the vehicle. This system served to control the contactors within the high-voltage battery pack. It was equipped with a fuse panel and emergency cut point located behind the left rear closeout panel within the rear cargo area of the vehicle. This cut point was intended for use by emergency services personnel as a means of immediately disabling the vehicle's entire electrical system (both high- and low-voltage) in an emergency situation. It was labeled with a yellow tag that featured a pictorial of a red firefighter's helmet with black wire cutters following a dotted line (**Figure 14**).

The high-voltage lithium-ion battery was rated to provide enough energy to propel the vehicle approximately 64 km (40 mi), depending on driving conditions. Recharging of the battery was achieved through a shore connection receptacle located above and aft of the left front axle at the A-pillar. **Figure 15** depicts an exemplar Chevrolet Volt with the recharging shore cord connected. This charging system could operate on either 120-V or 240-V household AC. Approximate recharge time was 10 hours at 120-V or 4 hours at 240-V.

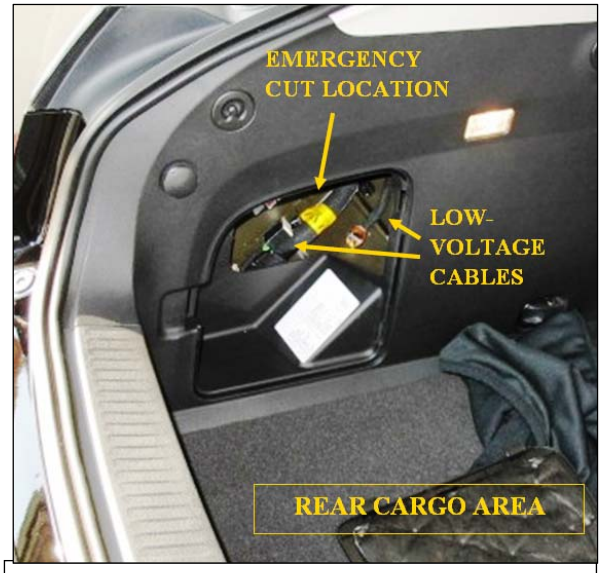


Figure 14: Emergency cut location for 12-V battery. Exemplar vehicle depicted.

Figure 15: Exemplar Chevrolet Volt recharging port.

Federal Motor Vehicle Safety Standard No. 305 Compliance

Federal Motor Vehicle Safety Standard No. 305: Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection is the standard applied to vehicles that use more than 48 nominal volts of electricity as propulsion and whose speed on a level paved surface is more than 40 km/h (25 mph). FMVSS No. 305 specifies performance requirements of electrolyte spillage, retention of propulsion batteries, and electrical isolation of the chassis from the high-voltage system during a crash event. The standard test requirements are summarized as follows:

- Not more than 5.0 liters (1.3 gal) of electrolyte from propulsion batteries shall spill outside the passenger compartment, and none shall spill in the passenger compartment, within 30 minutes after a barrier impact test.
- No propulsion battery system component located inside the passenger compartment shall move from its installed location.
- No propulsion battery system component located outside the passenger compartment shall enter the passenger compartment.
- Electrical isolation shall exist between the propulsion battery system and the vehicle electricity-conducting structure.

The Chevrolet Volt was visually inspected for compliance with FMVSS No. 305. A forklift operator employed at the vehicle salvage facility where the Chevrolet Volt was held utilized a forklift to raise the vehicle and enable an SCI inspection of the high-voltage battery pack and system components. The SCI team removed the skid plate and paneling protecting the vehicle's undercarriage to expose the lithium-ion battery pack, high-voltage cables, and high-voltage connection components (**Figure 16**). The high-voltage battery and surrounding system components were not displaced or damaged as a result of the crash. There was no leakage from the battery pack. There was no intrusion or damage to the battery pack or battery cover. There was also no intrusion of the battery pack or other high-voltage system components into the passenger compartment. Through this visual inspection, the SCI team determined that the integrity of the vehicle's high-voltage battery pack and surrounding system components was not compromised by the crash.

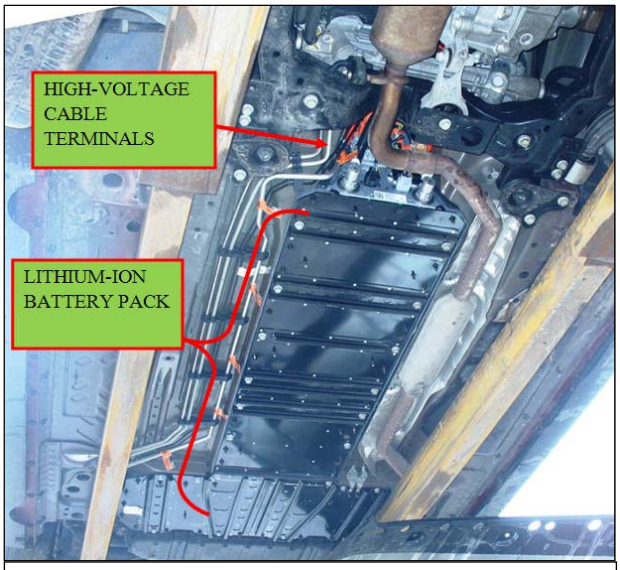


Figure 16: Undercarriage view of the Chevrolet Volt's undamaged high-voltage lithium-ion battery pack *(skid plate removed)*.

The Chevrolet Volt was equipped with an automatic disconnect between the high-voltage lithium-ion battery pack and the Voltec powertrain for electric isolation. This disconnect was activated by the SDM at AE. Because the insurance salvage facility instructed the SCI team to conduct a non-invasive inspection of the vehicle to retain maximum salvage value, the electrical isolation test was not conducted. However, data imaged from the Chevrolet Volt's SDM indicated that the "Battery Cutoff Loop" was successfully commanded upon AE.

Pursuant to the aforementioned observations, the SCI team determined that the Chevrolet Volt was in compliance with FMVSS No. 305.

2011 CHEVROLET VOLT OCCUPANT

Driver Demographics

Age / Sex:	54-year-old / Female
Height:	173 cm (68 in)
Weight:	73 kg (160 lb)
Eyewear:	None
Seat Type:	Bucket
Seat Track Position:	Middle
Manual Restraint Usage:	3-point lap and shoulder safety belt
Usage Source:	Vehicle inspection
Air Bags:	CAC steering wheel hub-mounted frontal air bag, knee bolster air bag, seatback-mounted side air bag, IC air bag
Alcohol/Drug Involvement:	None detected
Egress from Vehicle:	Exited vehicle with assistance
Transport from Scene:	Ground ambulance
Medical Treatment:	Transported to a local hospital for evaluation and released

Driver Injuries

Injury No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Left shoulder contusion	710402.1,2	Safety belt	Certain
2	Complaint of pain (neck)	Not Codeable	N/A	N/A

Source: surrogate interview (Driver's spouse)

Driver Kinematics

The driver of the Chevrolet Volt was seated in the forward facing bucket seat. The seat was adjusted to a middle track position, and the head restraint was adjusted fully down. The driver was restrained by the manual 3-point lap and shoulder safety belt. Restraint usage was determined from the post-crash condition of the safety belt system during the SCI inspection.

Upon impact with the Chevrolet K2500, the Chevrolet Volt's CAC frontal air bag and knee bolster air bag deployed and the belt pretensioners actuated. The driver initiated a forward trajectory in response to the 11 o'clock direction of force. She contacted and loaded the safety belt system, resulting in a shoulder contusion to her left shoulder from the shoulder portion of the belt. Belt loading evidence consisted of latch plate transfer to the webbing. The thoracic loading of the safety belt caused the driver's head to flex forward, and she contacted the deployed steering wheel hub-mounted air bag. Her left knee contacted and loaded the deployed knee bolster air bag, resulting in a scuff to the nylon fabric of the air bag.

As the front of the Chevrolet Volt engaged the right side of the Chevrolet K2500, the vehicles began to rotate. The Chevrolet Volt initiated slight CW rotation about its vertical axis, and the two vehicles side-slapped. This second event deployed the Chevrolet Volt's IC and left seatback-mounted air bags. The impact configuration also redirected the driver left laterally. She contacted the seatback air bag with her left flank and the IC with her head without injury.

The driver then rebounded into her seat as the Chevrolet Volt traversed the landscaped lawn and came to final rest. She was assisted from the vehicle by responding emergency services personnel and then transported via ground ambulance to a local hospital for evaluation.

2007 CHEVROLET SILVERADO K2500

Description

The 2007 Chevrolet Silverado K2500 was manufactured in November 2006 and was identified by the VIN: 1GCHK29U67E xxxxxx. The odometer reading was approximately 106,217 km (66,000 miles) at the time of the crash. **Figure 17** depicts the Chevrolet K2500 pickup truck at the time of SCI inspection. The four-wheel drive vehicle was powered by a 6.0-liter, 8-cylinder gasoline engine linked to a 5-speed automatic transmission. The service brakes were four-wheel, power-assisted discs with anti-lock (ABS). The Chevrolet K2500 had a 365 cm (143.5 in) wheelbase with a GVWR of 4,173 kg (9,200 lb). The front and rear GAWR were 2,177 kg (4,800 lb) and 2,760 kg (6,084 lb), respectively. The manufacturer of the Chevrolet K2500 recommended the tire size LT245/75R16 for all four axle positions, with cold tire pressures of 414 kPa (60 PSI) and 552 kPa (80 PSI), front and rear. Tire data related to the crash could not be determined due to replacement of all four tires post-crash as reported by the vehicle's owner.

Figure 17: Right side view of the Chevrolet K2500.

The interior of the Chevrolet K2500 was configured for the seating of six occupants. The front was equipped cloth split-bench seat with adjustable head restraints and integrated 3-point lap and shoulder safety belts for the outboard positions. The center seat was equipped with a lap belt and folding seatback that had a primary function of serving as a center armrest and storage compartment. The rear seat was a cloth bench seat with 3-point lap and shoulder safety belts for all three seating positions, and was equipped with adjustable head restraints for the outboard positions.

Exterior Damage

The Chevrolet K2500 was partially repaired prior to SCI case assignment and inspection and placed back in service. However, the vehicle owner reported to the SCI team during the partial inspection that replaced vehicle components included the right front fender, right front wheel, right front suspension components, front bumper, and front right headlamp assembly. There was no damage on the right side of the vehicle aft of the A-pillar that was attributable to the first impact event. Based on the owner's description of the direct damage and the lack of induced damage to adjacent components, the CDC corresponding to Event 1 was estimated at 02RFEW99.

Direct and induced damage from the second impact event was located aft of the rear axle on the right side plane and extended to the rear bumper corner, below the beltline. This included slight body deformation to the lower portion of the right rear fender between the rear axle and rear bumper with surface scratches and abrasions. The corresponding CDC for this damage pattern was 03RBEW1.

The third impact event consisted of undercarriage contact with the soil surface of the landscaped lawn of the residence southeast of the subject intersection. This non-horizontal impact involved undercarriage components. The corresponding CDC was 00UFDU1.

Event Data Recorder

The Chevrolet K2500 was equipped with an SDM mounted under the center console. The SDM had EDR capabilities to record and store two different event types, termed "Non-Deployment" and "Deployment". The EDR could store one non-deployment or two deployment events, if they occurred within five seconds of each other. If more than one non-deployment event occurred within five seconds, the EDR could only store the most severe event. Non-deployment events could be overwritten after 250 ignition cycles or another non-deployment event, whereas Deployment events could not be overwritten. Associated to each respective event was a 5-second pre-crash buffer that recorded Vehicle Speed, Engine Speed (RPM), Percent Throttle, and Brake Switch Circuit State data. The EDR monitored vehicle acceleration in the longitudinal direction, and the recording of an event could be triggered by a longitudinal crash pulse. Upon Algorithm Enable (AE), the EDR had the capacity to record 150 of milliseconds post-AE longitudinal Delta-V data in 10 millisecond intervals.

The data from the Chevrolet K2500's EDR was imaged using the Bosch Crash Data Retrieval Tool software version 3.8, via the DLC. The EDR data imaged from the Chevrolet K2500 had one distinct stored event, termed "Non-deployment", which was related to Event 1 of the subject crash. The event occurred on ignition counter number 17,376. The EDR reported complete recording for the event, which contained two pages linked by a field within the data sets. Data for the event reported that the Driver Belt Switch Circuit Status was "Buckled".

The pre-crash data buffer for the recorded "Non-Deployment" event was as follows:

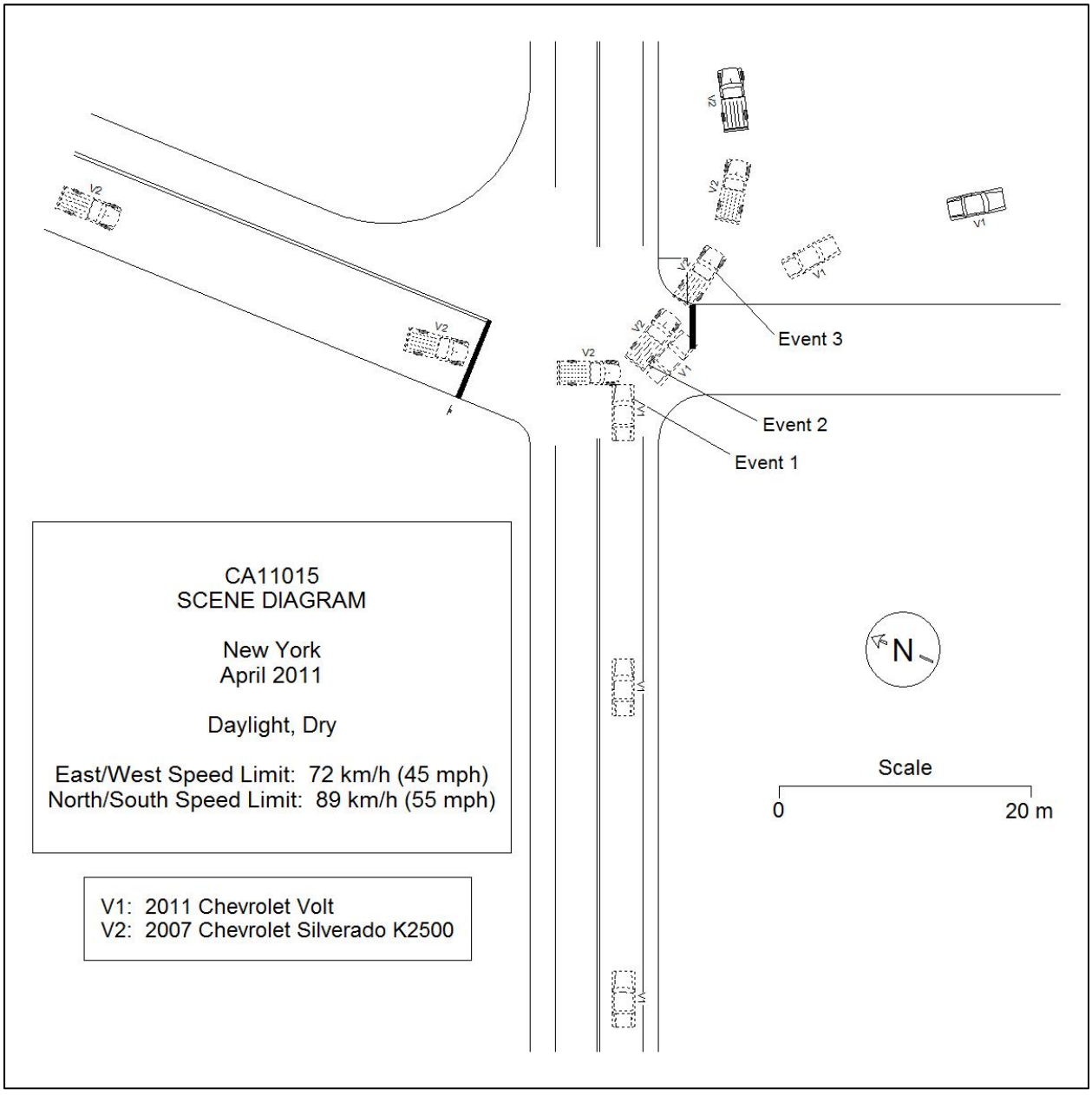
Time (seconds)	-5	-4	-3	-2	-1
Vehicle Speed	13 km/h (8 mph)	5 km/h (3 mph)	3 km/h (2 mph)	11 km/h (7 mph)	18 km/h (11 mph)
Engine Speed (RPM)	640	576	640	1728	2048
Percent Throttle	0%	0%	24%	24%	24%
Brake Switch Circuit Status	ON	ON	OFF	OFF	OFF

The maximum SDM Recorded Vehicle Velocity Change (delta-V) occurred 80 milliseconds after AE and had longitudinal component of -6.5 km/h (-4.03 mph). The imaged SDM data is included at the end of this technical report as **Attachment B**.

Occupant Data

Occupants of the Chevrolet K2500 pickup included an 84-year-old male driver, a 33-year-old male front right passenger, and a 26-year-old male seated in the second row right position. Official records reported that all three occupants utilized the vehicle's 3-point lap and shoulder safety belts at the time of the crash. No airbags within the vehicle deployed in the crash. None of the three occupants was injured or transported from the scene for medical attention.

SCENE DIAGRAM



ATTACHMENT A:

2011 Chevrolet Volt EDR Data

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	1G1RC6E49BU******
User	
Case Number	
EDR Data Imaging Date	05/20/2011
Crash Date	
Filename	CA11015 V1.CDRX
Saved on	Friday, May 20 2011 at 10:12:25
Collected with CDR version	Crash Data Retrieval Tool 3.8
Reported with CDR version	Crash Data Retrieval Tool 3.8
EDR Device Type	airbag control module
Event(s) recovered	Deployment, 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. Non-deployment Events can be overwiten after 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.
There are also two types of recorded crash events for Rollover Events. The first is the Non-Deployment (Non-rollover) Event. A Non-Deployment Event records data but does not deploy the air bag(s). A Non-Deployment Event contains Pre-Crash and Crash data. Non-Deployment Rollover event follow the same rules as FSR Non-Deployment events.
The SDM can store up to three Events. Once the SDM records a combination of three Deployment or locked Non-Deployment Events, the SDM must be replaced.

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 Events, the SDM will record 220 milliseconds of data after the deployment criteria is met and up to 70 milliseconds before the deployment criteria is met. For Non-Deployment Events, the SDM will record the first 300 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.
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 Non-Deployment (Non-rollover) Events, the SDM will record 750 milliseconds of data before a calibrated angle threshold is reached. For Deployment Events, the SDM will record up to 490 milliseconds of data before the deployment criteria is met and 250 milliseconds after the deployment criteria is met. Vehicle Recorded Acceleration and Roll Rate data are displayed in SAE sign convention.

- 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.
- Deployment loops can only be deployed once per module power cycle.

- Time Between Events is recorded at a 10 millisecond sample rate.

-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. Any air bag systems may be a source of an enable.

-Time From Algorithm Enable to Maximum SDM Recorded Vehicle Velocity Change is captured when the largest, absolute value of either the Longitudinal or Lateral Recorded Vehicle Velocity Change occurs. The Maximum may occur between the recorded 10 millisecond sample points.

-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.

-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

-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.

-The Algorithm Enable to Deployment Command Criteria Met times for the following will be indicated for whichever occurs first:
    -Driver Thorax/Curtain
    -Passenger Thorax/Curtain
    -Driver Pretensioner Loop #1 or Loop #2
    -Passenger Pretensioner Loop #1 or Loop #2

-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 Body Control Module, via the vehicle's communication network.

-The Belt Switch Circuit is wired directly to the SDM.

01038_SDM10-autoliv_r007

Event Data (General)

Ignition Cycles At Investigation	396
ESS # 1 Traceability Data	AU2577E01340259E
ESS # 2 Traceability Data	AT2577E0134CE865
ESS # 3 Traceability Data	AH2577E0131318D6
ESS # 4 Traceability Data	AJ2577E012E6B780
ESS # 5 Traceability Data	DA2577E013402898
ESS # 6 Traceability Data	DB2577E0134B456E
ESS # 7 Traceability Data	000000E000000000
ESS # 8 Traceability Data	000000E000000000
Vehicle Identification Number	1G1RC6E49BU******
System Type	Autoliv
Manufacturing Traceability Data	AS4895E050003983
Software Module Identifier 1	00CF22EB
Software Module Identifier 2	015C096D
Software Module Identifier 3	0189ECCF
End Model Part Number	00CF22EF

Event Data (Event Record 1)

Event Recording Complete	Yes
Event Record Type	Deployment
Crash Record Locked	Yes
Data Recording Complete - Deployment Status Data	Yes
Data Recording Complete - SDM Recorded Vehicle Velocity Change Data	Yes
Deployment Event Counter	1
Event Counter	1
OnStar Notification Event Counter	1
Algorithm Active: Rear	No
Algorithm Active: Rollover	Yes
Algorithm Active: Side	Yes
Algorithm Active: Frontal	Yes
Ignition Cycles At Event	389
Time Between Events (sec)	Data Not Available
Concurrent Event Flag Set	No
Event Severity Status: Rollover	No
Event Severity Status: Rear	No
Event Severity Status: Right Side	No
Event Severity Status: Left Side	No
Event Severity Status: Frontal Stage 2	No
Event Severity Status: Frontal Stage 1	Yes
Event Severity Status: Frontal Pretensioner	Yes
Driver 1st Stage Deployment Loop Commanded	Yes
Passenger 1st Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded	Yes
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 (If Equipped)	Yes
Passenger Pretensioner Deployment Loop #2 Commanded (If Equipped)	Yes
Driver Thorax Loop Commanded (If Equipped)	No
Passenger Thorax Loop Commanded (If Equipped)	No
Driver Row 2 Thorax Loop Commanded (If Equipped)	No
Passenger Row 2 Thorax Loop Commanded (If Equipped)	No
Driver Row 1 Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Passenger Row 1 Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Driver Row 2 Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Passenger Row 2 Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Driver Row 3 Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Passenger Row 3 Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Driver Knee Deployment Loop Commanded (If Equipped)	Yes
Passenger Knee Deployment Loop Commanded (If Equipped)	No
Driver Row 2 Pretensioner Deployment Loop Commanded (If Equipped)	No
Passenger Row 2 Pretensioner Deployment Loop Commanded (If Equipped)	No
Center Row 2 Pretensioner Deployment Loop Commanded (If Equipped)	No
Battery Cutoff Loop Commanded (If Equipped)	Yes
Driver Roll Bar Loop Commanded (If Equipped)	No
Passenger Roll Bar Loop Commanded (If Equipped)	No
Steering Column Energy Absorbing Loop Commanded (If Equipped)	No
Driver Head Rest Loop Commanded (If Equipped)	No
Passenger Head Rest Loop Commanded (If Equipped)	No
Driver Row 2 Head Rest Loop Commanded (If Equipped)	No
Passenger Row 2 Head Rest Loop Commanded (If Equipped)	No
Center Row 2 Head Rest Loop Commanded (If Equipped)	No
Driver Belt Switch Circuit Status	Buckled
Passenger Belt Switch Circuit Status	Not Buckled
Driver Seat Position Status (If Equipped)	Data Not Available
Passenger Seat Position Status (If Equipped)	Data Not Available
Passenger Seat Occupancy Status	Empty
Passenger Classification Status	Not Applicable
Passenger SIR Suppression Switch Circuit Status (If Equipped)	Data Not Available
Passenger Air Bag ON Indicator Status	Off
Passenger Air Bag OFF Indicator Status	On
Low Tire Pressure Warning Lamp	Off

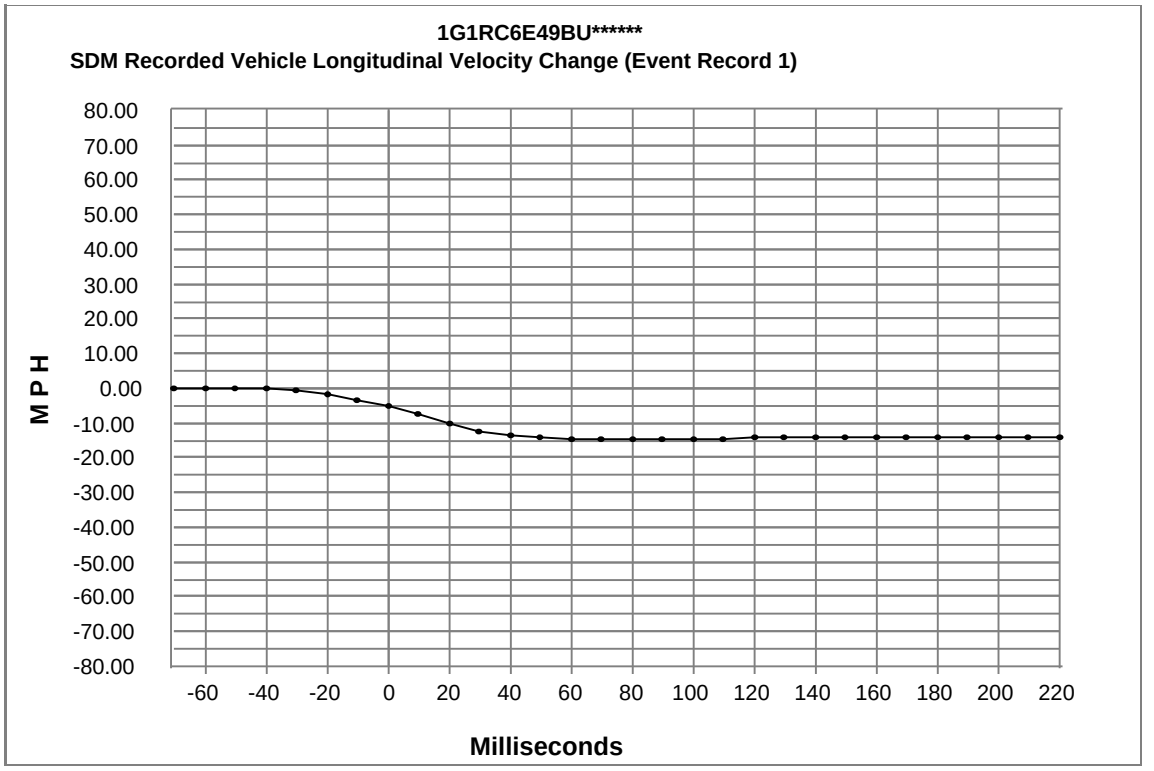
SIR Warning Lamp Status	Off
SIR Warning Lamp ON/OFF Time Continuously (seconds)	310920
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	390
Ignition Cycles Since DTCs Were Last Cleared at Event Enable	253
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	B0052
Fault type	$00
Time From Algorithm Enable to Maximum SDM Recorded Vehicle Velocity Change (msec)	110
Longitudinal SDM Recorded Vehicle Velocity Change at time of Maximum SDM Recorded Vehicle Velocity Change MPH [km/h]	-15 [-24]
Lateral SDM Recorded Vehicle Velocity Change at time of Maximum SDM Recorded Vehicle Velocity Change MPH [km/h]	6 [10]
Driver 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	36
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	156
Passenger 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Data Not Available
Passenger 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Data Not Available
Driver Thorax/Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Data Not Available
Passenger Thorax/Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Data Not Available
Driver Pretensioner Time From Algorithm Enable to Deployment Loop #1 or Loop #2 Command Criteria Met (msec)	6
Passenger Pretensioner Time From Algorithm Enable to Deployment Loop #1 or Loop #2 Command Criteria Met (msec)	6
Rollover Sensor - time from Event Enable to time of angle threshold (msec)	0

Pre-Crash Data -1 to -.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
-1.0	No	No	No	-24 [-32]	Off
-0.5	No	No	No	-24 [-32]	Off

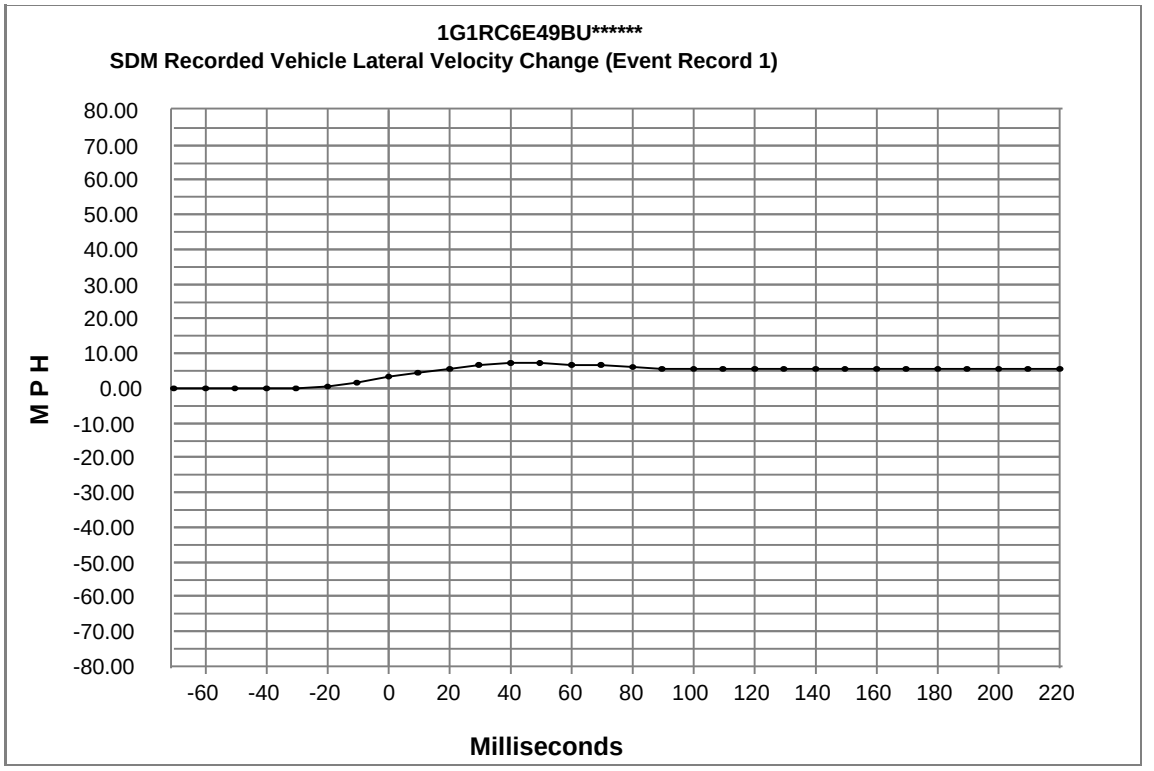
Pre-Crash Data -2.5 to -.5 sec (Event Record 1)

Times (sec)	Accelerator Pedal Position (percent)	Brake Switch Circuit State	Engine Speed	Throttle Position (%)	Vehicle Speed (MPH [km/h])
-2.5	15	Off	0	21	47 [76]
-2.0	15	Off	0	21	47 [75]
-1.5	8	Off	0	21	47 [75]
-1.0	0	On	0	21	45 [73]
-0.5	0	On	0	21	30 [48]



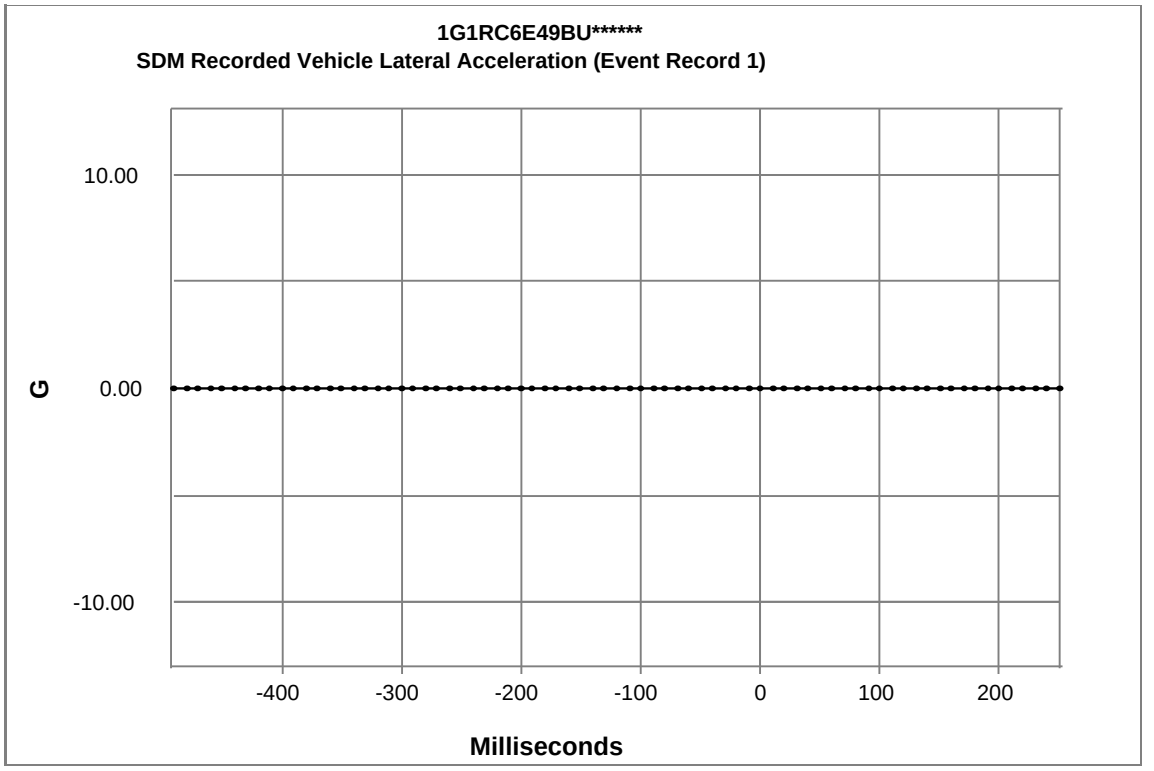
Time (msec)	Delta-V, longitudinal (MPH)	Delta-V, longitudinal (km/h)
-70	0.0	0.0
-60	0.0	0.0
-50	0.0	0.0
-40	0.0	0.0
-30	-0.6	-1.0
-20	-1.9	-3.0
-10	-3.1	-5.0
0	-5.0	-8.0
10	-7.5	-12.0
20	-9.9	-16.0
30	-12.4	-20.0
40	-13.7	-22.0
50	-14.3	-23.0
60	-14.9	-24.0
70	-14.9	-24.0
80	-14.9	-24.0
90	-14.9	-24.0
100	-14.9	-24.0
110	-14.9	-24.0
120	-14.3	-23.0
130	-14.3	-23.0

Time (msec)	Delta-V, longitudinal (MPH)	Delta-V, longitudinal (km/h)
140	-14.3	-23.0
150	-14.3	-23.0
160	-14.3	-23.0
170	-14.3	-23.0
180	-14.3	-23.0
190	-14.3	-23.0
200	-14.3	-23.0
210	-14.3	-23.0
220	-14.3	-23.0



Time (msec)	Delta-V, lateral (MPH)	Delta-V, lateral (km/h)
-70	0.0	0.0
-60	0.0	0.0
-50	0.0	0.0
-40	0.0	0.0
-30	0.0	0.0
-20	0.6	1.0
-10	1.9	3.0
0	3.1	5.0
10	4.3	7.0
20	5.6	9.0
30	6.8	11.0
40	7.5	12.0
50	7.5	12.0
60	6.8	11.0
70	6.8	11.0
80	6.2	10.0
90	5.6	9.0
100	5.6	9.0
110	5.6	9.0
120	5.6	9.0
130	5.6	9.0

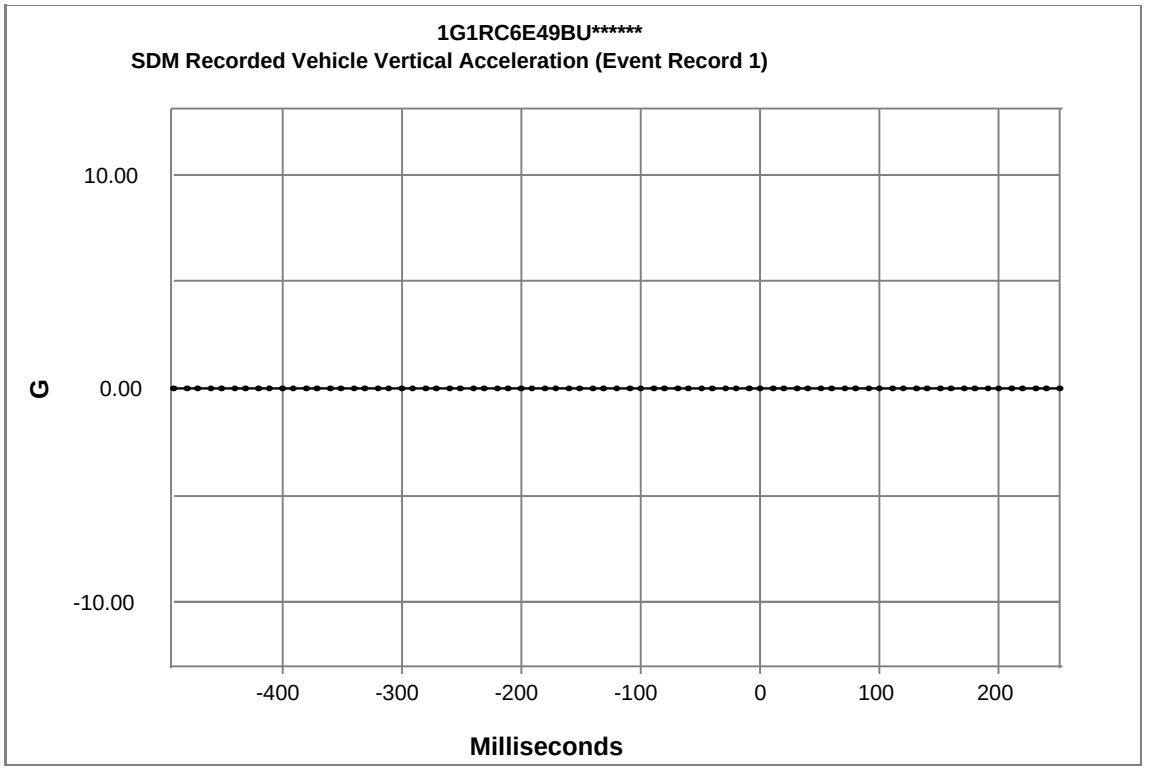
Time (msec)	Delta-V, lateral (MPH)	Delta-V, lateral (km/h)
140	5.6	9.0
150	5.6	9.0
160	5.6	9.0
170	5.6	9.0
180	5.6	9.0
190	5.6	9.0
200	5.6	9.0
210	5.6	9.0
220	5.6	9.0



Time	g
-490	0.0
-480	0.0
-470	0.0
-460	0.0
-450	0.0
-440	0.0
-430	0.0
-420	0.0
-410	0.0
-400	0.0
-390	0.0
-380	0.0
-370	0.0
-360	0.0
-350	0.0
-340	0.0
-330	0.0
-320	0.0
-310	0.0
-300	0.0
-290	0.0
-280	0.0
-270	0.0
-260	0.0
-250	0.0

Time	g
-240	0.0
-230	0.0
-220	0.0
-210	0.0
-200	0.0
-190	0.0
-180	0.0
-170	0.0
-160	0.0
-150	0.0
-140	0.0
-130	0.0
-120	0.0
-110	0.0
-100	0.0
-90	0.0
-80	0.0
-70	0.0
-60	0.0
-50	0.0
-40	0.0
-30	0.0
-20	0.0
-10	0.0
0	0.0

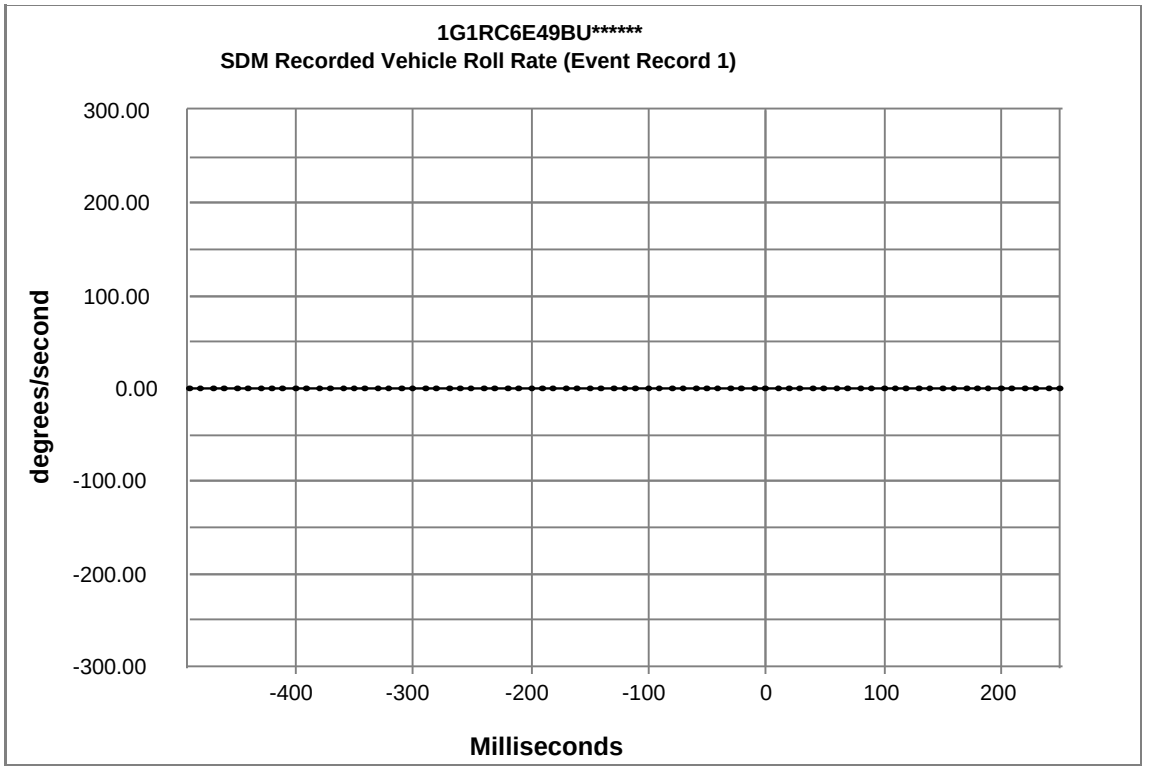
Time	g
10	0.0
20	0.0
30	0.0
40	0.0
50	0.0
60	0.0
70	0.0
80	0.0
90	0.0
100	0.0
110	0.0
120	0.0
130	0.0
140	0.0
150	0.0
160	0.0
170	0.0
180	0.0
190	0.0
200	0.0
210	0.0
220	0.0
230	0.0
240	0.0
250	0.0



Time	g
-490	0.0
-480	0.0
-470	0.0
-460	0.0
-450	0.0
-440	0.0
-430	0.0
-420	0.0
-410	0.0
-400	0.0
-390	0.0
-380	0.0
-370	0.0
-360	0.0
-350	0.0
-340	0.0
-330	0.0
-320	0.0
-310	0.0
-300	0.0
-290	0.0
-280	0.0
-270	0.0
-260	0.0
-250	0.0

Time	g
-240	0.0
-230	0.0
-220	0.0
-210	0.0
-200	0.0
-190	0.0
-180	0.0
-170	0.0
-160	0.0
-150	0.0
-140	0.0
-130	0.0
-120	0.0
-110	0.0
-100	0.0
-90	0.0
-80	0.0
-70	0.0
-60	0.0
-50	0.0
-40	0.0
-30	0.0
-20	0.0
-10	0.0
0	0.0

Time	g
10	0.0
20	0.0
30	0.0
40	0.0
50	0.0
60	0.0
70	0.0
80	0.0
90	0.0
100	0.0
110	0.0
120	0.0
130	0.0
140	0.0
150	0.0
160	0.0
170	0.0
180	0.0
190	0.0
200	0.0
210	0.0
220	0.0
230	0.0
240	0.0
250	0.0



Time	deg/sec
-490	0
-480	0
-470	0
-460	0
-450	0
-440	0
-430	0
-420	0
-410	0
-400	0
-390	0
-380	0
-370	0
-360	0
-350	0
-340	0
-330	0
-320	0
-310	0
-300	0
-290	0
-280	0
-270	0
-260	0
-250	0

Time	deg/sec
-240	0
-230	0
-220	0
-210	0
-200	0
-190	0
-180	0
-170	0
-160	0
-150	0
-140	0
-130	0
-120	0
-110	0
-100	0
-90	0
-80	0
-70	0
-60	0
-50	0
-40	0
-30	0
-20	0
-10	0
0	0

Time	deg/sec
10	0
20	0
30	0
40	0
50	0
60	0
70	0
80	0
90	0
100	0
110	0
120	0
130	0
140	0
150	0
160	0
170	0
180	0
190	0
200	0
210	0
220	0
230	0
240	0
250	0

Event Data (Event Record 2)

Event Recording Complete	Yes
Event Record Type	Deployment
Crash Record Locked	Yes
Data Recording Complete - Deployment Status Data	Yes
Data Recording Complete - SDM Recorded Vehicle Velocity Change Data	Yes
Deployment Event Counter	2
Event Counter	2
OnStar Notification Event Counter	2
Algorithm Active: Rear	No
Algorithm Active: Rollover	Yes
Algorithm Active: Side	Yes
Algorithm Active: Frontal	No
Ignition Cycles At Event	389
Time Between Events (sec)	.53
Concurrent Event Flag Set	No
Event Severity Status: Rollover	No
Event Severity Status: Rear	No
Event Severity Status: Right Side	No
Event Severity Status: Left Side	Yes
Event Severity Status: Frontal Stage 2	No
Event Severity Status: Frontal Stage 1	No
Event Severity Status: Frontal Pretensioner	No
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	Yes
Passenger Pretensioner Deployment Loop #1 Commanded	Yes
Driver Pretensioner Deployment Loop #2 Commanded (If Equipped)	Yes
Passenger Pretensioner Deployment Loop #2 Commanded (If Equipped)	Yes
Driver Thorax Loop Commanded (If Equipped)	Yes
Passenger Thorax Loop Commanded (If Equipped)	No
Driver Row 2 Thorax Loop Commanded (If Equipped)	No
Passenger Row 2 Thorax Loop Commanded (If Equipped)	No
Driver Row 1 Roof Rail/Head Curtain Loop Commanded (If Equipped)	Yes
Passenger Row 1 Roof Rail/Head Curtain Loop Commanded (If Equipped)	Yes
Driver Row 2 Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Passenger Row 2 Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Driver Row 3 Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Passenger Row 3 Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Driver Knee Deployment Loop Commanded (If Equipped)	No
Passenger Knee Deployment Loop Commanded (If Equipped)	No
Driver Row 2 Pretensioner Deployment Loop Commanded (If Equipped)	No
Passenger Row 2 Pretensioner Deployment Loop Commanded (If Equipped)	No
Center Row 2 Pretensioner Deployment Loop Commanded (If Equipped)	No
Battery Cutoff Loop Commanded (If Equipped)	Yes
Driver Roll Bar Loop Commanded (If Equipped)	No
Passenger Roll Bar Loop Commanded (If Equipped)	No
Steering Column Energy Absorbing Loop Commanded (If Equipped)	No
Driver Head Rest Loop Commanded (If Equipped)	No
Passenger Head Rest Loop Commanded (If Equipped)	No
Driver Row 2 Head Rest Loop Commanded (If Equipped)	No
Passenger Row 2 Head Rest Loop Commanded (If Equipped)	No
Center Row 2 Head Rest Loop Commanded (If Equipped)	No
Driver Belt Switch Circuit Status	Buckled
Passenger Belt Switch Circuit Status	Not Buckled
Driver Seat Position Status (If Equipped)	Data Not Available
Passenger Seat Position Status (If Equipped)	Data Not Available
Passenger Seat Occupancy Status	Empty
Passenger Classification Status	Not Applicable
Passenger SIR Suppression Switch Circuit Status (If Equipped)	Data Not Available
Passenger Air Bag ON Indicator Status	Off
Passenger Air Bag OFF Indicator Status	On
Low Tire Pressure Warning Lamp	Off

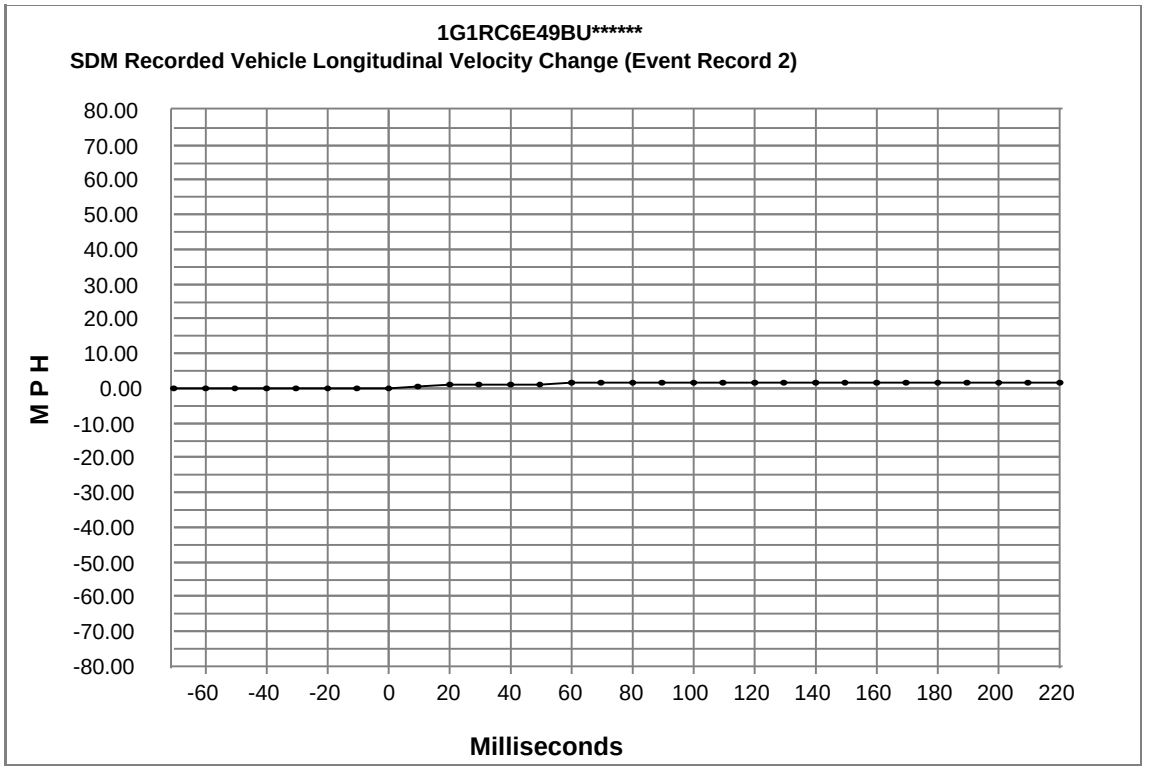
SIR Warning Lamp Status	Off
SIR Warning Lamp ON/OFF Time Continuously (seconds)	310920
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	390
Ignition Cycles Since DTCs Were Last Cleared at Event Enable	253
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	N/A
Fault type	N/A
Diagnostic Trouble Codes at Event:	B0052
Fault type	$00
Time From Algorithm Enable to Maximum SDM Recorded Vehicle Velocity Change (msec)	50
Longitudinal SDM Recorded Vehicle Velocity Change at time of Maximum SDM Recorded Vehicle Velocity Change MPH [km/h]	1 [2]
Lateral SDM Recorded Vehicle Velocity Change at time of Maximum SDM Recorded Vehicle Velocity Change MPH [km/h]	3 [5]
Driver 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Data Not Available
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Data Not Available
Passenger 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Data Not Available
Passenger 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Data Not Available
Driver Thorax/Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	9
Passenger Thorax/Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	9
Driver Pretensioner Time From Algorithm Enable to Deployment Loop #1 or Loop #2 Command Criteria Met (msec)	Data Not Available
Passenger Pretensioner Time From Algorithm Enable to Deployment Loop #1 or Loop #2 Command Criteria Met (msec)	Data Not Available
Rollover Sensor - time from Event Enable to time of angle threshold (msec)	0

Pre-Crash Data -1 to -.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
-1.0	No	No	No	-24 [-32]	Off
-0.5	No	No	No	-24 [-32]	Off

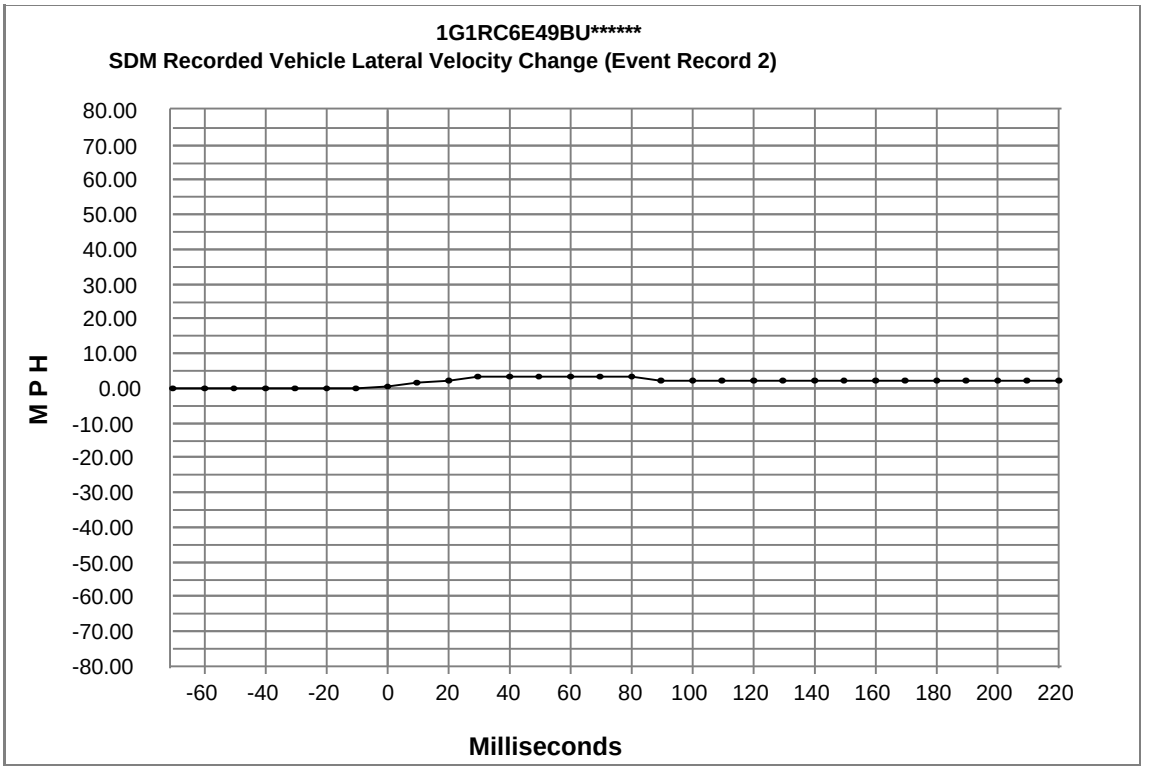
Pre-Crash Data -2.5 to -.5 sec (Event Record 2)

Times (sec)	Accelerator Pedal Position (percent)	Brake Switch Circuit State	Engine Speed	Throttle Position (%)	Vehicle Speed (MPH [km/h])
-2.5	15	Off	0	21	47 [75]
-2.0	8	Off	0	21	47 [75]
-1.5	0	On	0	21	45 [73]
-1.0	0	On	0	21	30 [48]
-0.5	0	On	0	21	26 [42]



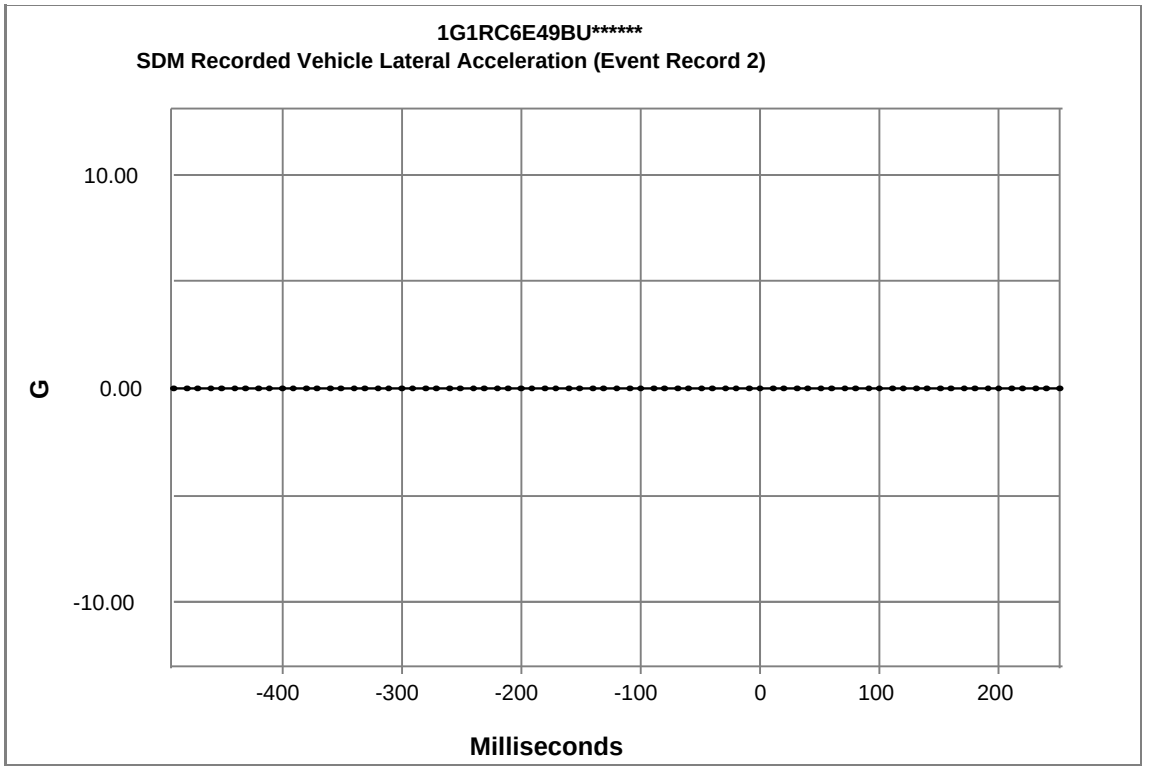
Time (msec)	Delta-V, longitudinal (MPH)	Delta-V, longitudinal (km/h)
-70	0.0	0.0
-60	0.0	0.0
-50	0.0	0.0
-40	0.0	0.0
-30	0.0	0.0
-20	0.0	0.0
-10	0.0	0.0
0	0.0	0.0
10	0.6	1.0
20	1.2	2.0
30	1.2	2.0
40	1.2	2.0
50	1.2	2.0
60	1.9	3.0
70	1.9	3.0
80	1.9	3.0
90	1.9	3.0
100	1.9	3.0
110	1.9	3.0
120	1.9	3.0
130	1.9	3.0

Time (msec)	Delta-V, longitudinal (MPH)	Delta-V, longitudinal (km/h)
140	1.9	3.0
150	1.9	3.0
160	1.9	3.0
170	1.9	3.0
180	1.9	3.0
190	1.9	3.0
200	1.9	3.0
210	1.9	3.0
220	1.9	3.0



Time (msec)	Delta-V, lateral (MPH)	Delta-V, lateral (km/h)
-70	0.0	0.0
-60	0.0	0.0
-50	0.0	0.0
-40	0.0	0.0
-30	0.0	0.0
-20	0.0	0.0
-10	0.0	0.0
0	0.6	1.0
10	1.9	3.0
20	2.5	4.0
30	3.1	5.0
40	3.1	5.0
50	3.1	5.0
60	3.1	5.0
70	3.1	5.0
80	3.1	5.0
90	2.5	4.0
100	2.5	4.0
110	2.5	4.0
120	2.5	4.0
130	2.5	4.0

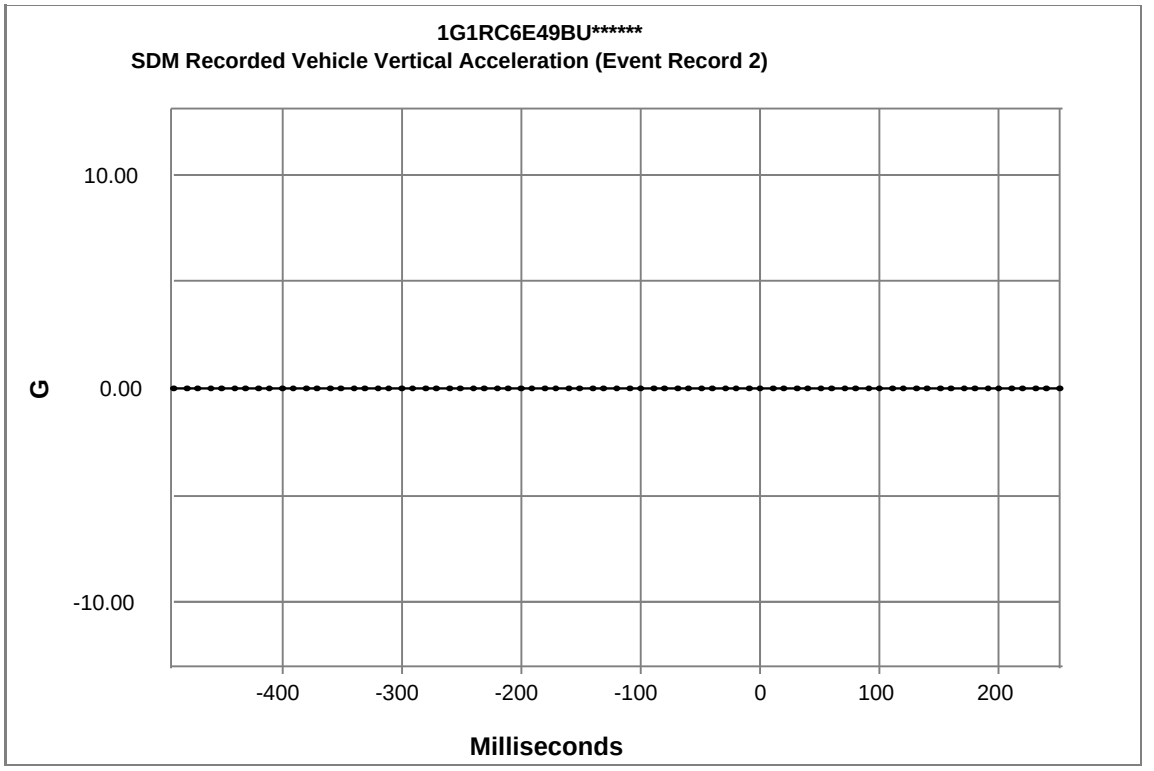
Time (msec)	Delta-V, lateral (MPH)	Delta-V, lateral (km/h)
140	2.5	4.0
150	2.5	4.0
160	2.5	4.0
170	2.5	4.0
180	2.5	4.0
190	2.5	4.0
200	2.5	4.0
210	2.5	4.0
220	2.5	4.0



Time	g
-490	0.0
-480	0.0
-470	0.0
-460	0.0
-450	0.0
-440	0.0
-430	0.0
-420	0.0
-410	0.0
-400	0.0
-390	0.0
-380	0.0
-370	0.0
-360	0.0
-350	0.0
-340	0.0
-330	0.0
-320	0.0
-310	0.0
-300	0.0
-290	0.0
-280	0.0
-270	0.0
-260	0.0
-250	0.0

Time	g
-240	0.0
-230	0.0
-220	0.0
-210	0.0
-200	0.0
-190	0.0
-180	0.0
-170	0.0
-160	0.0
-150	0.0
-140	0.0
-130	0.0
-120	0.0
-110	0.0
-100	0.0
-90	0.0
-80	0.0
-70	0.0
-60	0.0
-50	0.0
-40	0.0
-30	0.0
-20	0.0
-10	0.0
0	0.0

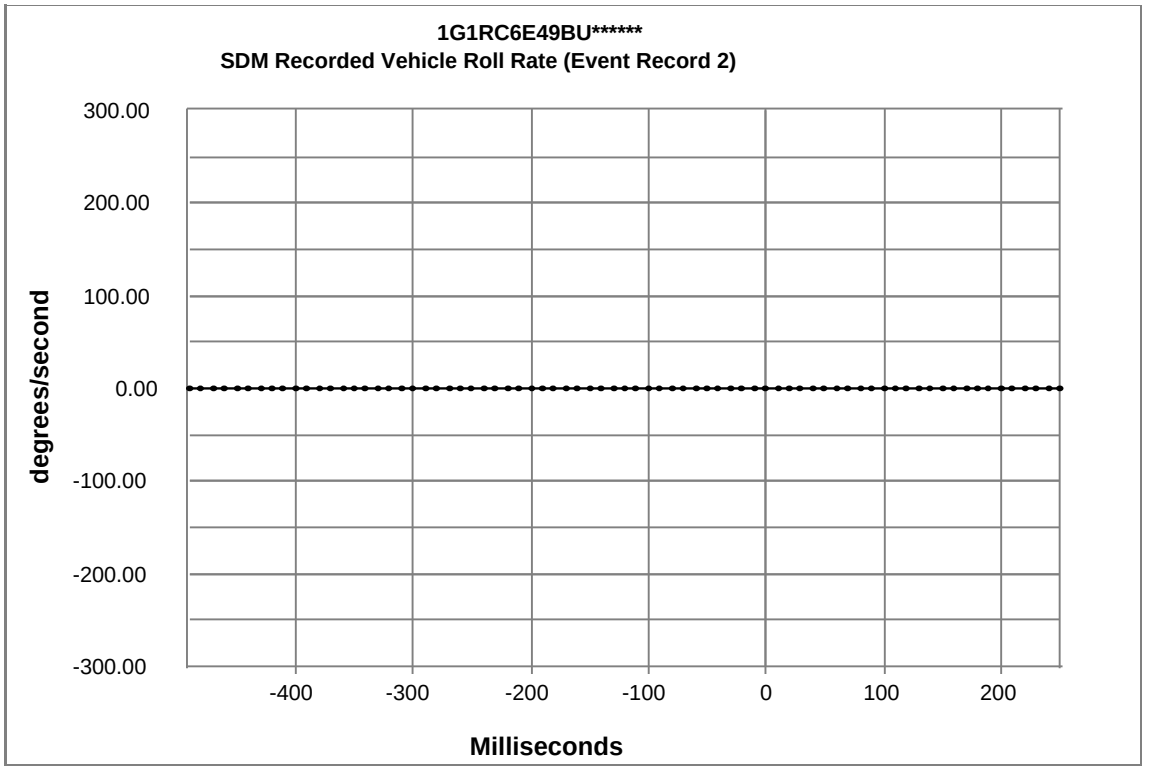
Time	g
10	0.0
20	0.0
30	0.0
40	0.0
50	0.0
60	0.0
70	0.0
80	0.0
90	0.0
100	0.0
110	0.0
120	0.0
130	0.0
140	0.0
150	0.0
160	0.0
170	0.0
180	0.0
190	0.0
200	0.0
210	0.0
220	0.0
230	0.0
240	0.0
250	0.0



Time	g
-490	0.0
-480	0.0
-470	0.0
-460	0.0
-450	0.0
-440	0.0
-430	0.0
-420	0.0
-410	0.0
-400	0.0
-390	0.0
-380	0.0
-370	0.0
-360	0.0
-350	0.0
-340	0.0
-330	0.0
-320	0.0
-310	0.0
-300	0.0
-290	0.0
-280	0.0
-270	0.0
-260	0.0
-250	0.0

Time	g
-240	0.0
-230	0.0
-220	0.0
-210	0.0
-200	0.0
-190	0.0
-180	0.0
-170	0.0
-160	0.0
-150	0.0
-140	0.0
-130	0.0
-120	0.0
-110	0.0
-100	0.0
-90	0.0
-80	0.0
-70	0.0
-60	0.0
-50	0.0
-40	0.0
-30	0.0
-20	0.0
-10	0.0
0	0.0

Time	g
10	0.0
20	0.0
30	0.0
40	0.0
50	0.0
60	0.0
70	0.0
80	0.0
90	0.0
100	0.0
110	0.0
120	0.0
130	0.0
140	0.0
150	0.0
160	0.0
170	0.0
180	0.0
190	0.0
200	0.0
210	0.0
220	0.0
230	0.0
240	0.0
250	0.0



Time	deg/sec
-490	0
-480	0
-470	0
-460	0
-450	0
-440	0
-430	0
-420	0
-410	0
-400	0
-390	0
-380	0
-370	0
-360	0
-350	0
-340	0
-330	0
-320	0
-310	0
-300	0
-290	0
-280	0
-270	0
-260	0
-250	0

Time	deg/sec
-240	0
-230	0
-220	0
-210	0
-200	0
-190	0
-180	0
-170	0
-160	0
-150	0
-140	0
-130	0
-120	0
-110	0
-100	0
-90	0
-80	0
-70	0
-60	0
-50	0
-40	0
-30	0
-20	0
-10	0
0	0

Time	deg/sec
10	0
20	0
30	0
40	0
50	0
60	0
70	0
80	0
90	0
100	0
110	0
120	0
130	0
140	0
150	0
160	0
170	0
180	0
190	0
200	0
210	0
220	0
230	0
240	0
250	0

ATTACHMENT B:

2007 Chevrolet Silverado K2500 EDR Data

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	1GCHK29U67E******
User	
Case Number	
EDR Data Imaging Date	05/20/2011
Crash Date	
Filename	CA11015 V2.CDRX
Saved on	Friday, May 20 2011 at 15:02:52
Collected with CDR version	Crash Data Retrieval Tool 3.8
Reported with CDR version	Crash Data Retrieval Tool 3.8
EDR Device Type	airbag control module
Event(s) recovered	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). It contains 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 longitudinal 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 a Deployment Level Event, 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 before 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 contains Pre-Crash and Crash data. The SDM can store up to two different Deployment Events, if they occur within five seconds of one another. If multiple Non-Deployment Events occur within five seconds prior to a Deployment Event, then the most severe Non-Deployment Event will be recorded and locked. If multiple Non-Deployment Events precede a Deployment Event, and occur within five seconds of each other (but not necessarily all within five seconds of the Deployment Event), then the most severe of the Non-Deployment Events (which may have occurred more than five seconds prior to the Deployment Event) will be recorded and locked. If a Deployment Level Event occurs within five seconds after the Deployment Event, the Deployment Level Event will overwrite any non-locked Non-Deployment Event. If multiple Non-Deployment Events occur within five seconds prior to a Deployment Event, and one or more of those events was a Pretensioner Deployment Event, then the most recent Pretensioner Deployment Event will be recorded and locked. 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 Longitudinal Velocity Change reflects the change in longitudinal velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Longitudinal Velocity Changeis 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 will record 100 milliseconds of data after deployment criteria is met and up to 50 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM can record up to the first 150 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.
-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.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if:
- -the SDM receives a message with an "invalid" flag from the module sending the pre-crash data
- -no data is received from the module sending the pre-crash data
- -no module present to send the pre-crash data

-Engine Speed is reported at two times the actual value in the following vehicles, if the vehicle is equipped with a 6.6L Duramax diesel engine (RPO LB7, LBZ, LLY, or LMM):
- -2001-2006 Chevrolet Silverado
- -2007 Chevrolet Silverado Classic
- -2001-2006 GMC Sierra
- -2007 GMC Sierra Classic
- -2006-2007 Chevrolet Express
- -2006-2007 GMC Savana
- -2003-2009 Chevrolet Kodiak
- -2003-2009 GMC Topkick

-Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit. If the vehicle's electrical system is compromised during a crash, the state of the Driver's Belt Switch Circuit may be reported other than the actual state.
-The Time between Non-Deployment to Deployment Events is displayed in seconds. If the time between the two events is greater than 25.4 seconds, "N/A" is displayed in place of the time.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
-Multiple Events will indicate whether one or more associated events preceded the recorded event.
-Multiple Events Not Recorded can be used in the following scenarios:
- -If a single event is recorded, this parameter will indicate whether one or more associated events prior to the recorded event was not recorded due to insufficient record space (because there were more events than there were available event records).
- -If two associated events are recorded, this parameter for the first event will indicate whether one or more associated events prior to the first event was not recorded due to insufficient record space.
- -If two associated events are recorded, this parameter for the second event will indicate whether one or more associated events between the first and second events was not recorded due to insufficient record space.

-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 Speed, Engine Speed, and Percent Throttle data are transmitted by the Powertrain Control Module (PCM), via the vehicle's communication network, to the SDM.
-Brake Switch Circuit Status data is transmitted by either the ABS module or the PCM, via the vehicle's communication network, to the SDM.
-The Belt Switch Circuit is wired directly to the SDM.

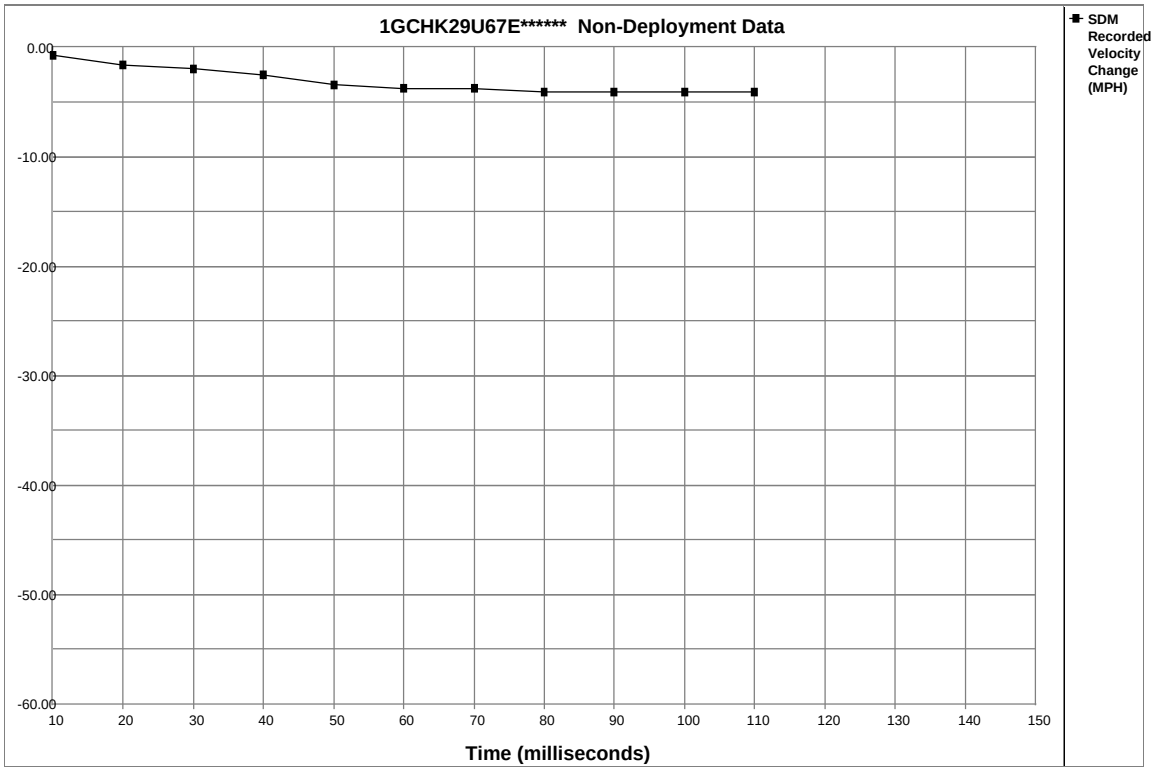
01027_SDMGF_r004

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Ignition Cycles At Non-Deployment	17376
Ignition Cycles At Investigation	17595
Maximum SDM Recorded Velocity Change (MPH)	-4.11
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	87.5
Crash Record Locked	No
Event Recording Complete	Yes
Multiple Events	No
Multiple Events Not Recorded	No

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	8	640	0
-4	3	576	0
-3	2	640	24
-2	7	1728	24
-1	11	2048	24

Seconds Before AE	Brake Switch Circuit State
-8	ON
-7	ON
-6	ON
-5	ON
-4	ON
-3	OFF
-2	OFF
-1	OFF



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.62	-1.55	-1.86	-2.48	-3.41	-3.72	-3.72	-4.03	-4.03	-4.03	-4.03	N/A	N/A	N/A	N/A