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Special Crash Investigations: On-Site Ambulance Crash Investigation; Vehicle: 2011 Chevrolet Silverado 3500 Type III Ambulance; Location: Pennsylvania; Crash Date: November 2022

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Each crash represents a unique sequence of events and generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicles or their safety systems. This report and case data are based on information available to the Special Crash Investigation team on the date this report was submitted.

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16. Abstract

This on-site investigation documents the fatal multi-event crash of a 2011 Chevrolet Silverado 3500 Type III ambulance that was traveling with lights and sirens activated when it entered a four-way intersection and struck a 2017 Toyota RAV4, then a traffic-control pole, and finally a large tree. After the impact with the ambulance, the Toyota rotated and struck a 2009 Infiniti G37X. The ambulance was driven by an unbelted 23-year-old male with an unbelted 42-year-old male front-right passenger, both EMTs. The driver had fatal (K-level) injuries and the front passenger had incapacitating (A-level) injuries. Both were transported to a Level I trauma center. The driver died prior to admittance. The Toyota's belted 23-year-old male driver had incapacitating (A-level) injuries and his treatment status is unknown. The Infiniti's belted 25-year-old male driver was uninjured.

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Special Crash Investigations
On-Site Ambulance Crash Investigation
Case Number: CR22020
Vehicle: 2011 Chevrolet Silverado 3500 Type III Ambulance
Location: Pennsylvania
Crash Date: November 2022

Background

This report documents the on-site investigation of a fatal multi-event crash of a 2011 Chevrolet Silverado 3500 Type III ambulance (Figure 1), 2017 Toyota RAV4, and Infiniti G37X in Pennsylvania in November 2022. The ambulance was traveling in emergency mode with lights and sirens activated when it entered a traffic-controlled, multi-lane, four-way intersection and struck the Toyota's right side with its front (Event 1). The ambulance then rotated clockwise, departed the roadway, and struck a traffic-control pole (Event 2) and then a large diameter tree with its left side (Event 3). After impact with the ambulance, the Toyota rotated counterclockwise and struck the left side of the stationary Infiniti with its right side (Event 4).

The ambulance was driven by an unbelted 23-year-old male with an unbelted 42-year-old male front-right passenger, both EMTs. The driver had fatal (K-level) injuries, and the front passenger had incapacitating (A-level) injuries. Both were transported to a Level I trauma center. The ambulance driver died prior to admission. The passenger's medical records were requested but not released. During an interview he provided a short list of injuries; however, his hospital treatment is unknown. The ambulance's event data recorder (EDR) did not record any crash events and its front air bags did not deploy. The Toyota's belted 23-year-old male driver had incapacitating (A-level) injuries. He was transported by ambulance to a local Level I trauma center; however, his treatment and stay are unknown. The Infiniti's belted 25-year-old male driver was police-reported as uninjured and not transported. All three vehicles were towed from the scene to a secure location. The Infiniti was released prior to the inspection and was not available for the Special Crash Investigation's (SCI) investigation. The ambulance and Toyota remained in a secure location for the duration of the investigation.

Figure 1. Left-side view of the ambulance

The crash was identified by the National Highway Traffic Safety Administration's Office of Emergency Medical Services. Notification was forwarded to the SCI group and assigned for an on-site investigation by the SCI team at Crash Research & Analysis in December 2022. The SCI team initiated contact with the police department to retrieve a police crash report and obtain cooperation for the vehicle inspection. The ambulance service was contacted and cooperative for an inspection of the ambulance. The on-site investigation included the exterior and interior inspection of the ambulance to measure exterior deformation and interior damage and intrusion, documentation of evidence of interior occupant contacts, and examination of the manual and supplemental restraint systems. The specialty equipment and features of the patient compartment were also inspected and documented. The crash site was inspected, photographed, and measured by total station. The Toyota was photographed and crush deformation measurements were estimated. The SCI investigator conducted interviews and gathered information from the ambulance service specific to its operating procedures, policies, and personnel involved in this crash.

Summary

Crash Site

The crash occurred at 10:57 p.m. at a lighted, multi-lane, four-way, traffic-controlled intersection. The National Weather Service reported conditions as light rain/drizzle with a temperature of 9.4 °C (49 °F), 86 percent humidity, and west-by-southwest winds of 22.5 km/h (14 mph) with gusts of 40.2 km/h (25 mph). The police reported roadway conditions in the area were wet and slippery.

The intersection's four-lane, east-to-west leg was level, straight, and constructed of asphalt (Figures 2 and 3) with a posted speed limit of 56 km/h (35 mph). The travel lanes were separated by a double yellow center line. All lanes were 3.6 m (11.8 ft) wide and separated by dashed white lane lines.

Figure 2. The ambulance driver's view, looking west. Note visual obstructions to the left.

Figure 3. The Toyota's path of travel, looking north

The intersection's three-lane, north-to-south leg had a 2-percent downhill grade with a posted speed limit of 40 km/h (25 mph). The roadway had a right-turn-only lane, and a travel through/left-turn lane. The stop bar for the north travel lanes was positioned 21 m (68.9 ft) from the mouth of the intersection.

A small brick wall approximately 0.7 meters (2.5 ft) tall ran along the intersection's southeast quadrant, bordering a steep embankment that led to an apartment complex. There were thick bushes and trees planted atop the embankment. The SCI investigator noted that the wall, bushes, and embankment obstructed visibility and created a sound barrier across this quadrant of the intersection.

The intersection's northwest quadrant was level and had grass, bushes, and large trees (Figure 4). A 25 cm (9.8 in) metal traffic-control pole was 45 cm (17.7 in) from the roadway and 20 m (65.6 ft) from the initial impact. This was the first object struck off the roadway. A 130 cm (51.2 in) diameter tree (Figure 5) was 30.4 m (99.7 ft) from the initial impact and 5 m (16.4 ft) from the roadway's edge.

Figure 4. Looking northwest at the pole and tree associated with Events 2 and 3

Figure 5. Looking west at the tree associated with Event 3 and the ambulance's final rest

Concrete sidewalks bordered all sides of the roadway and pedestrian crosswalks were at each leg of the intersection. The traffic-controlled, vertically positioned, tri-colored lights were non-directional and ran in cycles of approximately 30 seconds for each intersecting travel way. A crash diagram is included at the end of this report.

Ambulance Agency, Crew, and Transport Description

The ambulance was owned and operated by a municipal ambulance agency. The agency was not associated with any medical treatment center and provided emergency transport with basic and advanced life support medical services. The ambulance crews ran with a designated driver EMT and an advanced EMT passenger who treated the transported patients. The ambulance was driven by a trained EMT with an advanced EMT passenger at the time of the crash.

According to the passenger's interview, the ambulance company had ambulance crews work an 8 hour on/6 hour off shift with 16 total working hours for the day. The passenger confirmed that 3 to 4 hours of the 6 hours off between shifts were used in overtime. The ambulance crew were in the last half-hour of their 22-hour day shift. They had just transported a patient to a nearby facility and were called to an emergency scene. They were operating the ambulance in emergency mode with lights and sirens activated.

Pre-Crash

The ambulance was traveling west in the second lane from the right with its lights and sirens activated enroute to an emergency. A police-reported estimated speed at the time of the crash was 72 km/h (45 mph). The traffic-controlled intersection displayed red lights to the ambulance and there were no obstructions to the ambulance driver's view of the traffic-control lights or the travel lanes directly ahead before the ambulance entered the intersection. The Toyota was traveling north in the second lane from the right and entered the intersection at an EDR-reported speed of 52 km/h (32.3 mph) 4.9 seconds prior to Event 1 (trigger 6 pre-crash data). The Infinity was stopped at the traffic light in the right lane, facing east. The intersection's at-crash traffic control lighting sequence was confirmed by a security camera video recording during the SCI inspection. A copy of the video was requested but not received.

Crash

The ambulance's front struck the forward aspect of the Toyota's right side (Event 1). Due to its mass, the momentum of the ambulance carried it through the initial front impact as it was deflected approximately 15° clockwise. The ambulance traveled through the intersection and departed the roadway's right side approximately 15 m (49 ft) northwest of the initial impact. The ambulance then struck the traffic control signal pole at the mid-aspect of the driver's door (Event 2). The pole deformed the left door and intruded into the occupant compartment. It separated at its breakaway base and was displaced west into the intersection's electrical control box. The ambulance continued traveling off road into the intersection's northwest quadrant, running over several small bushes and finally striking the large tree. This impact began at the forward aspect of the driver's door, overlapping the pole damage and then struck the front-left section of its passenger compartment (Event 3). The ambulance came to rest facing northwest, 31.7 meters (104.0 ft) from the initial impact. The driver's and passenger's frontal air bags were not commanded to deploy during any of the crash events.

The force of the initial impact caused all supplemental restraints in the Toyota to deploy. It separated from the impact with a rapid counterclockwise rotation of approximately 270° and struck the Infinity that was stopped at the intersection. The Toyota's right-rear axle and D-pillar area struck the Infinity's left side, forward of its B-pillar (Event 4). The Toyota came to final rest against the Infinity, facing east.

Post-Crash

The ambulance driver received blunt force injuries to the head and neck as a result of the impact to the pole. The ambulance's front passenger received incapacitating injuries as a result of the crash events. He exited the vehicle through the right-front door window, notified EMS personnel of the incident, and attempted to aid the ambulance driver. The driver was removed from the vehicle by EMS personnel through the driver's door. Both EMTs were transported to a Level I trauma center. The driver was pronounced deceased prior to admittance into the center. The passenger was admitted into the center, but treatment details are unknown. The Toyota driver also received incapacitating injuries from the initial impact with the ambulance. He was removed through the driver's door by EMS personnel and transported to a Level I trauma center. His treatment details are unknown. The Infiniti driver was uninjured and not transported to a hospital. All three vehicles were towed from the scene to a secure location. The Infiniti was released prior to the SCI investigation and was not available.

2011 Chevrolet Silverado 3500 Type III Ambulance

Description

The 2011 Chevrolet Silverado 3500 Type III ambulance (Figure 6) was a 2-door truck-based vehicle manufactured as an incomplete unit in 2010 with VIN 1GB3C0CL4BFxxxxxx. Due to the impact with the tree, the left-front corner/door was crushed, and the manufacturer's label could not be documented. It had a 6.6-liter, V8 diesel engine linked to an automatic transmission on a 418 cm (165 in) wheelbase. It did not have any crash avoidance equipment. The gross vehicle weight rating (GVWR) was 5,988 kg (13,200 lb). The front and rear gross axle weight ratings were 2,540 kg (5,600 lb) and 4,423 kg (9,750 lb).

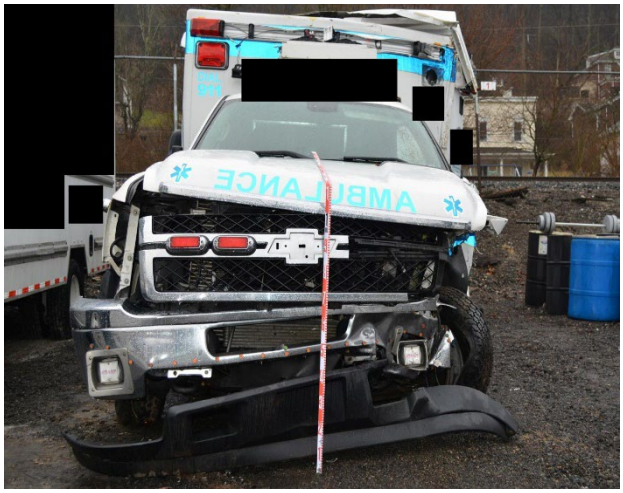

Figure 6. Front view of the ambulance

The vehicle manufacturer's recommended tire size was LT235/80R17E front and rear with a recommended cold tire pressure of 480 kPa (70 psi) for the front and 450 kPa (65 psi) for the rear. The ambulance had Goodyear Wrangler tires of the recommended size mounted on OEM aluminum alloy wheels. All tire tread depths were 5 mm (9/32 in) or greater.

The Chevrolet was completed as a Type III ambulance during secondary manufacturing in April 2011 by Life Line Emergency Vehicle, Inc.[1] Emergency services operations equipment, such as warning lights, sirens, and radio communications were installed in its cab and on the vehicle's exterior.

Vehicle History

The Carfax report said the ambulance was bought new by the current owner in June 2011 and was serviced throughout the years since. In May 2017 the ambulance was involved in a frontal and left crash with a minor severity rating. It was reported as drivable. No post-crash service records were found in the report. In February 2021 a manufacturer safety recall was issued for NHTSA #21V054 concerning the front passenger air bag Takata inflator. A remedy was available. No service records were found in the report concerning this recall. In February 2021 the ambulance was involved in a rear crash. No service records were found in the report

[1] Life Line Emergency Vehicles, Sumner, IA.

concerning this crash. In November 2022 it was involved in a left-side type crash with a pole and stationary object, which is the subject of this investigation.

NHTSA Recalls and Investigations

A search of the NHTSA recall database (www.nhtsa.gov/recalls) in December 2022 revealed no recalls for the ambulance based on its VIN. A recall database search of the same VIN in February 2025 revealed one open or unrepaired recall, NHTSA #21V054, that is referenced in the Vehicle History section of this report.

Exterior Damage

The ambulance had moderate damage to the front plane as a result of the initial impact with the Toyota (Event 1, Figure 7). The direct damage started centerline of the bumper and extended 85 cm (33.5 in) to the left-bumper corner. The left-front axle was crushed rearward 12 cm (4.7 in) and absorbed a significant amount of energy from the crash. The residual crush was measured with a total station and the resultant profile was: C1 = 59 cm (23.2 in), C2 = 42 cm (16.5 in), C3 = 15 cm (5.9 in), C4 = 4 cm (1.6 in), C5 = 0 cm, C6 = 0 cm. The maximum crush was located 85 cm (33.5 in) at the left corner from the bumper's centerline and measured 59 cm (23.2 in). The ambulance was considered outside of scope for the WinSMASH program's vehicle-to-vehicle algorithm due to its GVWR. The barrier equivalent speed calculated by the WinSMASH program was 20 km/h (12 mph). The results are shown in this report but are not available in the Crash Investigation Sampling System (CISSweb) due to its truck deformation classification (TDC) status.[2] The TDC assigned to this damage pattern was 11FDEW3.

Figure 7. Left oblique view of the ambulance showing damage from Event 1

The ambulance sustained moderate damage during the impact with the pole and tree (Events 2 and 3, Figures 8 and 9). The damage from both objects overlapped. The damage from the pole started 303 cm (119.3 in) forward of the left-rear axle at the center of the driver's door. The

[2] SAE J1301_202206 – SAE recommended practice describing truck (medium, heavy, and articulated combination) collision damage in an alphanumeric format.

direct damage from the pole extended rearwards 104 cm (40.9 in) to the rear of the cab. There was a maximum crush of 18 cm (7.1 in) located 10 cm (3.9 in) forward of the left B-pillar. Heavy surface abrasions ran longitudinally across the door, roof rail, and sill. This contact with the pole caused the driver's door to be intruded laterally into the cab 15 cm (5.9 in) and ended at the left B-pillar. The large diameter tree contact overlapped the pole contact with direct damage starting at the left A-pillar and ending at the patient compartment's front-left corner (Figure 10). The residual crush was measured along the cab's left side with a total station and the resultant profile was: C1 = 0 cm, C2 = 0 cm, C3 = 11 cm (4.3 in), C4 = 16 cm (6.3 in), C5 = 18 cm (7.1 in), C6 = 0 cm. Due to the TDC status and GVWR, the ambulance was considered outside the WinSMASH program's scope. The barrier equivalent speed calculated by the WinSMASH program was 20 km/h (12 mph). The results are shown in this report but are not available in CISSweb due to its TDC. The TDC for Event 2 is 11LPAW3 and 11VLANB for Event 3.

Figure 8. Top view of the damage to the cab (Event 2)

Figure 9. View of the driver's door and the pole damage

Figure 10. Damage to the patient compartment (Event 3)

Event Data Recorder

The ambulance had a sensing and diagnostic module (SDM) that monitored and controlled the diagnostic sensing and deployable commands for the vehicle's supplemental safety systems. The module had EDR capabilities. The EDR was imaged with version 23.0.2 of the Bosch Crash Data Retrieval software via a direct-to-module connection by the SCI investigator. The EDR data is included in Appendix A of this report.

The EDR could store up to two crash events, termed either non-deployment or deployment events. Non-deployment events occur when the recording trigger threshold is met or exceeded (minimum of 8 km/h [5 mph]). Data from non-deployments can be overwritten by subsequent events. Deployment events cannot be overwritten from the SDM. This SDM also categorizes non-air bag deployment events when there is an event in which non-air bag devices, such as pretensioners, have actuated. This type of event can be overwritten given a subsequent air bag deployment event. Associative to each reported event is a 5.0-second pre-crash buffer. Several data points are recorded on a recurring basis of 0.5 seconds, which should include vehicle speed, accelerator pedal (% full), service brake status, engine RPM, ABS activity, and steering data. For unknown reasons there were no events recorded by the EDR.

Interior Damage

The interior damage to the ambulance cab was moderate (Figure 11). The driver's door was laterally intruded into the cab 15 cm (5.9 in). The left B-pillar was also laterally intruded 10 cm (3.9 in) into the cab and the driver's seat was shifted towards the vehicle's centerline 8 cm (3.1 in).

Figure 11. View of the ambulance's driver side

The top sector of the tilt style, 4-spoke steering wheel was deformed 2 cm (0.8 in) forward as a result of occupant loading. At the time of the crash the steering wheel was positioned approximately 180° from its current position in the investigative photos. There were a few cracks in the windshield extending laterally from the left A-pillar that resulted from the exterior crash forces. Blood, hair, and glass were embedded in the left visor's underside and on the windshield header. Heavy blood splatter was found across the left roof rail and was associated to the driver's contact with the pole. The accelerator pedal was broken at its base and suggests the driver's foot was on the accelerator pedal at the time of the crash. The driver's knee bolster was intact and

unmarked. The driver's door was removed from the cab during the extrication process but was still intact at the time of the inspection (Figure 12). There were several possible left arm and left flank occupant contacts to the door's upper-rear quadrant.

Figure 12. View of the driver's interior door

Figure 13. View of the center console

Figure 14. View of the passenger's side and computer mount

Positioned in the cab's center tunnel was an emergency equipment box that held the communications, emergency lights, and sirens controls (Figure 13). The siren and public address system control module was observed to have been pushed into the control box. This indicated a possible occupant contact from the front passenger. A Toughbook computer arm and swivel was mounted on the center tunnel's left side (Figure 14). The computer was not found in the cab. However, according to the investigating police officer, the computer was found in the front passenger's toe pan area, post-crash.

The front passenger's side interior was unremarkable. There was a post-crash bloodied handprint on the right A-pillar grab handle. The window glass appeared to have been broken outward.

Patient Compartment Interior Damage

The patient compartment interior had structural damage at the front-left section from the impact with the tree. There were no occupants in the ambulance's rear and its inspection was unremarkable.

Manual Restraint System

The ambulance had 3-point continuous loop lap and shoulder seat belts for each cab position using sliding latch plates, fixed D-rings, and fixed anchors attached to the seat bases (Figures 15 and 16). Both front seat belts had retractor pretensioners.

Based on the police report and SCI investigator observations, the driver and front passenger were not belted at the time of the crash. The retractor pretensioners did not actuate. The driver's seat belt was stowed, and the retractor's emergency mode was locked due to the crush/deformation at the left B-pillar. The passenger's seat belt was operational. There was no evidence of frictional loading (abrasions) to the latch plates or webbings that could be attributed to occupant loading. Such evidence would be expected in a crash of this severity had the occupants been using the restraints.

Figure 15. View of the driver's seat belt

Figure 16. View of the front passenger's seat belt

The patient compartment had a lap and shoulder seat belt for the captain's chair and lap belts for the bench seat on the compartment's right rear side. The three seats were fitted with retractor systems at the base of the seatbacks.

Supplemental Restraint System

The ambulance had dual stage driver's and passenger's frontal air bags. It did not have side impact or inflatable curtain (IC) air bags. The SDM did not sense the crash events, and the air bags were not commanded to be deployed. The SCI investigator created a field safety notification for the non-deployment of the air bags and uploaded it to CISSweb for review.

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2011 Chevrolet Silverado 3500 Type III Ambulance Occupants

EMT Demographics (Driver)

Age/sex:	23 years/male
Height:	175 cm (69 in)
Weight:	122 kg (269 lb)
Eyewear:	Unknown
Seat type:	Forward-facing bucket seat with adjustable head restraint
Seat track position:	Between middle and rear most
Manual restraint usage:	Lap and shoulder belt available, not used
Usage source:	Vehicle inspection and police report
Air bags:	Driver's frontal available; not deployed
Alcohol/drug involvement:	No alcohol or drugs
Egress from vehicle:	Removed due to perceived serious injuries
Transport from scene:	Transport to Level I trauma center
Type of medical treatment:	Fatal

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Atlanto-occipital dislocation	650208.3	Isolated IPC #1 Other vehicle or object – Pole Isolated IPC #2 Other vehicle or object – Tree	Probable Possible
2	Atlanto-occipital fracture	650216.2	Isolated IPC #1 Other vehicle or object – Pole Isolated IPC #2 Other vehicle or object – Tree	Probable Possible
3	Bilateral cerebellar contusions, NFS	140402.3	Isolated IPC #1 Other vehicle or object – Pole Isolated IPC #2 Other vehicle or object – Tree	Probable Possible
4	Bilateral cerebral contusions, NFS	140620.3	Isolated IPC #1 Other vehicle or object – Pole Isolated IPC #2 Other vehicle or object – Tree	Probable Possible

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
5	Diffuse subarachnoid hemorrhage involving right cerebral convexity of brain	140693.2	Isolated IPC #1 Other vehicle or object – Pole Isolated IPC #2 Other vehicle or object – Tree	Probable Possible
6	Diffuse subarachnoid hemorrhage involving left cerebral convexity of brain	140693.2	Isolated IPC #1 Other vehicle or object – Pole Isolated IPC #2 Other vehicle or object – Tree	Probable Possible
7	Fracture of skull base involving frontal, mid, and occipital portions	150200.3	Isolated IPC #1 Other vehicle or object – Pole Isolated IPC #2 Other vehicle or object – Tree	Probable Possible
8	Fracture of left frontal bones of skull extending to left temporal, parietal, and occipital	150400.2	Isolated IPC #1 Other vehicle or object – Pole Isolated IPC #2 Other vehicle or object – Tree	Probable Possible
9	Patterned red abrasion 6 x 3 inches on left frontal scalp; patterned red abrasion 6 x 4 inches on left parietal-occipital scalp	110202.1	Isolated Other vehicle or object – Pole	Probable
10	Ecchymosis of left orbit	210402.1	Isolated Other vehicle or object – Pole	Probable
11	Fracture of left humerus, NFS	751100.2	Isolated IPC Left door panel – Left rear upper quadrant	Probable
12	Patterned abrasion on left posterior upper arm, 7 x 4 inches	710202.1	Isolated Left door panel – Left rear upper quadrant	Probable
13	Patterned abrasion on left posterior forearm, 4 x 2 inches	710202.1	Isolated Left door panel – Left rear upper quadrant	Probable
14	Red abrasion on left posterior wrist, 1 x 1/4 inches	710202.1	Isolated Left door panel – Left rear upper quadrant	Probable

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
15	Left atrial contusion, 2 cm	441002.1	Isolated Front – Steering wheel (combination of rim and hub/spoke)	Probable
16	Spleen laceration, 4 cm	544224.3	Isolated Left door panel – Left rear lower quadrant	Probable
17	Patterned abrasion 3 x 1/2 inches on left back	410202.1	Isolated Left side – Left B-pillar	Possible
18	Red abrasion 3 x 1/8 inches on left lateral abdomen	510202.1	Isolated Left door panel – Left rear lower quadrant	Probable
19	Red abrasion on left knee, 1 x 1/2 inch	810202.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Probable

Source: Autopsy report (internal).

Driver Kinematics

According to the front passenger's interview, the ambulance driver was sitting in a normal posture at the time of the crash and was attentive to the driving task. The initial impact with the Toyota nominally displaced him forward and to the left. The unrestrained driver loaded the steering wheel's upper portion causing deformation to the wheel and likely contacted the knee bolster. The ambulance's mass carried the vehicle through the initial impact, and it was deflected to the right off the roadway. During this time the driver was rebounding from Event 1, and his head was in line with the window and body was against the middle of the driver's door. When the pole struck and intruded into the driver's door, the driver's head contacted the intruding pole causing injuries to his skull, brain, left arm, and left abdomen. The driver continued rebounding and contacted the left B-pillar with his back. The final impact with the tree displaced the driver forward again into the steering wheel and roof header. The driver was removed from the vehicle through the driver's door due to perceived serious injuries. He was transported to a Level I trauma center where resuscitation attempts were made; however, he was pronounced deceased shortly after arrival.

EMT Demographics (Front-Right Passenger)

Age/sex:	42 years/male
Height:	Unknown
Weight:	Unknown
Eyewear:	Unknown
Seat type:	Forward-facing bucket seat adjustable head restraint
Seat track position:	Between middle and rear most
Manual restraint usage:	Lap and shoulder belt available, not used
Usage source:	Vehicle inspection and police report
Air bags:	Passenger's frontal available, not deployed

Alcohol/drug involvement: No test performed
Egress from vehicle: Exited from vehicle under own power
Transport from scene: Transport to Level I trauma center
Type of medical treatment: Unknown

Front-Right Passenger Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Broken vertebrae in back, NFS	600000.9	Injured, unknown source	Unknown
2	Left knee injury, NFS	810099.1	Isolated Interior-other interior object(s) – Computer mount arm and swivel	Probable

Source: Occupant interview.

Front-Right Passenger Kinematics

According to his interview, at the time of the crash the ambulance's front passenger was sitting with a normal posture and was not belted. He was holding a tablet computer in his hands, reading about the call they were responding to. The initial impact with the Toyota displaced him forward and to the left. The unrestrained front passenger contacted the Toughbook computer mount positioned on the center console's right side. The ambulance's mass carried the vehicle through the initial impact, and it was deflected to the right off the roadway. During this time the front passenger was rebounding from Event 1. When the pole struck the ambulance's left side, the front passenger again contacted the center instrument panel where the computer mount was located and where he likely remained for the duration of the tree impact and final rest. According to his interview, the front passenger regained consciousness and saw the driver slumped against the steering wheel. He exited the ambulance through his window and notified the emergency response system of the crash. He then attempted to resuscitate the ambulance driver who was mostly non-responsive. The front passenger was transported to a Level I trauma center. Details regarding his treatment are unknown. He refused to authorize a medical release form but gave a brief account of his injuries during the interview. An additional head injury was reported by the front passenger but could not be coded due to medical documentation not being received.

2017 Toyota RAV4

Description

The 2017 Toyota RAV4 was a 4-door SUV (Figure 17) manufactured in May 2017 with VIN 2T3DFREVXHWxxxxxx. It had a 2.5-liter, inline 4-cylinder gasoline engine linked to an automatic transmission with all-wheel drive on a 266 cm (104.0 in) wheelbase. The service brakes were a power-assisted 4-wheel disc system. Steering was a speed-sensitive electric rack-and-pinion system. It had an antilocking braking system, electronic stability control, traction control, crash imminent braking, forward collision warning, pedestrian automatic braking, blind spot detection, lane departure warning, lane keeping assistance, daytime running lights, and adaptive cruise control.

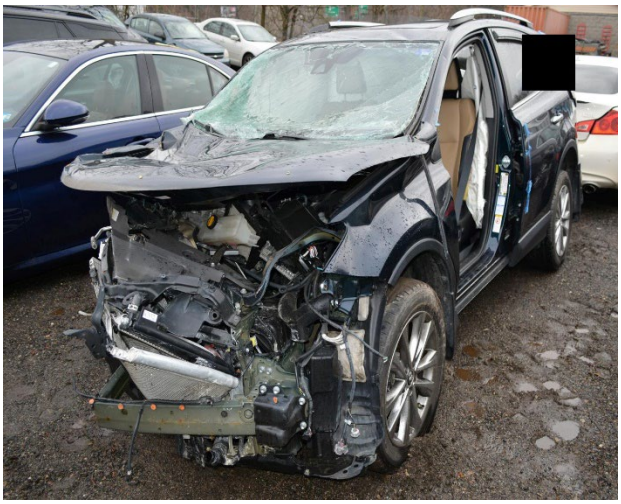

Figure 17. Left-front view of the Toyota

The manufacturer's recommended tire size was 235/55R18 front and rear with a recommended cold tire pressure of 220 kPa (32 psi). At the time of the SCI inspection, the Toyota had a Goodyear Assurance tire on the right-front position and NITTO Crosstrek tires of the recommended size and mounted on OEM aluminum alloy wheels on the other positions. All tire tread depths were 7 mm (9/32 in).

The Toyota had two rows of seats for five occupants, two in the front and three in the second row. At the time of the SCI inspection the driver's seat was reclined approximately 15° aft of vertical. All seating surfaces were leather. All seat positions had 3-point lap and shoulder seat belts for manual restraints. Supplemental restraint was provided by front seat belt retractor and buckle pretensioners, driver's and passenger's frontal air bags, outboard seat-mounted side-impact air bags, dual sensing (side-impact and rollover) roof rail side IC air bags, driver knee air bag, and a seat cushion air bag in the front passenger's seat. All supplemental restraint systems, except for the front passenger's seat cushion, deployed as a result of the crash forces. It was not apparent at the SCI inspection whether the seat cushion air bag deployed or not.

Vehicle History

According to the Carfax report, the Toyota was bought new in December 2017 and titled in Pennsylvania. It was serviced several times for routine maintenance. In January 2022 the vehicle was sold to its second and current owner. It was titled again in Pennsylvania. In November 2022 it was involved in a multi-event crash with moderate damage, which is the subject of this report.

NHTSA Recalls and Investigations

A search of the NHTSA recall database (http://www.nhtsa.gov/recalls) in December 2022 using the Toyota's VIN revealed no open or unrepaired recalls. A second search in February 2025 revealed one open recall that was assigned in November 2023, NHTSA #23V734, regarding the Toyota's 12-volt batteries and was unrelated to this crash.

Exterior Damage

The Toyota sustained moderate damage to its frontal and right sides during the initial impact with the ambulance (Event 1, Figure 18). The damage started at the right A-pillar base, 90 cm (35.4 in) forward of its right-side centerline and extended forward 145 cm (57.1 in) to the right-front corner. The right wheelbase was reduced to 8 cm (3.1 in).

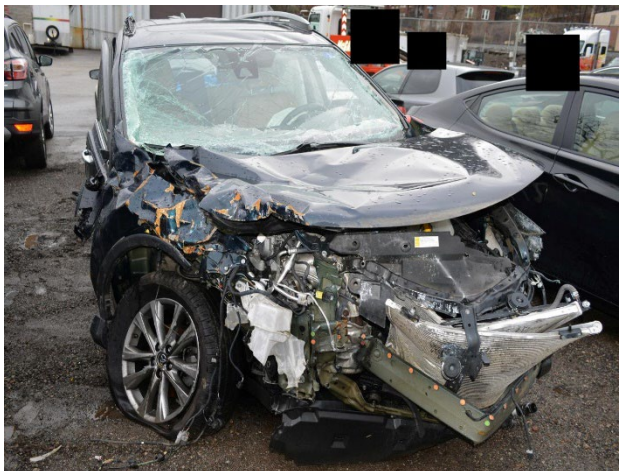

Figure 18. Front view of the Toyota

At the time of the SCI inspection the Toyota's damage was considered as a front impact, and the residual crush was measured along the front bumper with a total station. Upon review and crash reconstruction, it was determined that the impact damage was the result of a side impact. An estimated resultant profile for the right side was calculated by overlaying the damage profiles of the Toyota and ambulance (Figure 19). The estimated resultant profile was C1 = 0 cm, C2 = 24 cm (9.4 in), C3 = 48 cm (18.9 in), C4 = 67 cm (26.4 in), C5 = 100 cm (39.4 in), C6 = 30 cm (11.8 in). The maximum crush was 100 cm (39.4 in) and located 117 cm (46.1 in) forward of the right A-pillar base. Due to the ambulance's TDC and GVWR, this profile was considered out of scope of the WinSMASH program's vehicle-to-vehicle algorithm. For comparative purposes the impact severity was calculated by the WinSMASH program's barrier algorithm and had a barrier

equivalent speed of 56 km/h (34.7 mph). The collision deformation classification assigned to the damage pattern for Event 1 is 02RFEW5.[3]

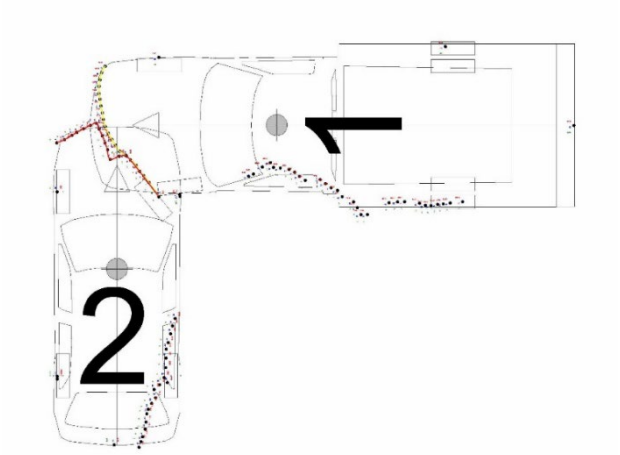

Figure 19. Scaled diagram of the crush profiles overlapped to calculate an estimated side crush profile for the Toyota

The Toyota also had moderate damage to its right-rear side as a result of its impact to the stationary Infiniti (Event 4, Figure 20). The damage started at 49 cm (19.2 in) rearward of the right-side centerline and extended rearward 188 cm (74.0 in) to the right-rear corner. The residual crush was measured with a total station and the resultant profile was C1 = 34 cm (13.4 in), C2 = 33 cm (13.0 in), C3 = 25 cm (9.8 in), C4 = 15 cm (5.9 in), C5 = 13 cm (5.1 in), C6 = 0 cm. Maximum crush was 34 cm (13.4 in) and located at the right-rear corner. The impact severity was calculated by the WinSMASH program's missing vehicle algorithm. The total change in velocity (delta V) was 28 km/h (17.3 mph). The longitudinal and lateral components were 26 km/h (16.1 mph) and -9 km/h (-5.5 mph). The calculated result was considered reasonable and fit the crush model. The collision deformation classification assigned to the damage pattern was 05RZAW4.

[3] SAE J224_202205 – SAE recommended practice describing vehicle collision damage in an alphanumeric format.

Figure 20. Damage to the right rear of the Toyota from Event 4

Event Data Recorder

The Toyota had an air bag electronic crash unit that monitored and controlled the diagnostic sensing and deployment commands for the vehicle's supplemental safety systems. The unit had EDR capabilities. The EDR component was imaged and reported with version 23.0.2 of the Bosch Crash Data Retrieval software via direct-to-module connection by the investigating law enforcement officers and shared as a PDF with the SCI investigator. The imaged data was sanitized and is included in Appendix B of this report.

The EDR could store up to two pre-crash recordings termed "memory maps" and two post-crash data memory maps for each crash type, two for frontal and rear, two for a side crash, and two for a rollover event. These maps are termed "triggers" (TRGs). Data from a non-deployment trigger is unlocked and can be overwritten by either a deployment trigger or a non-deployment trigger of greater severity when the memory maps become filled. Deployment triggers are locked and cannot be overwritten.

Associative to each reported event is a 5.0-second pre-crash buffer. Several data points are asynchronously recorded in 0.5-second intervals, which include: vehicle speed, accelerator pedal (% full), engine throttle (%), engine rpm, motor rpm, service brake (on/off), brake oil pressure (Mpa), and steering input.

The EDR reported six TRG events. The first two TRGs (invalid 1, and fourth prior 1) were considered unrelated to the crash sequences. The first related triggers were TRGs 2 and 3 and were attributed to Event 1 measuring longitudinal and lateral data. TRGs 5 and 6 were related to Event 4 and captured the longitudinal and lateral data of that event. Due to the asynchronistic pre-crash recording, the data associated with TRGs 5 and 6 was recorded at the time of TRG 2. TRGs 2, 3, 5, and 6 all share the same pre-crash data. The lateral delta V values for the TRGs were calculated by integrating the reported lateral acceleration data points from the floor sensor.

Pre-Crash

The EDR reported that 5 seconds prior to the side impact, the vehicle was traveling at 53 km/h (32.9 mph) as the Toyota entered the intersection. Reconstruction of the crash data determined that the Toyota steered left in an attempted avoidance maneuver 0.9 seconds prior to algorithm

enable. The ignition cycle count at the time of the pre-crash recording was 5,234 and 5,235 at the time of the imaging. At crash, the air bag warning light was off and the driver's seat belt status was on (fastened).

Event 1 (TRGs 2 and 3)

The right-side impact with the ambulance initiated the algorithm enable and deployed the driver's and passenger's frontal air bags, outboard seat-mounted side-impact air bags, pretensioners, and IC air bags at 5 milliseconds into TRG 3. The driver's second stage frontal air bag deployed 20 milliseconds into TRG 3. The maximum longitudinal delta V of this impact was -26.2 km/h (-16.3 mph) at 91 milliseconds into TRG 3 and a maximum lateral delta V of -35.7 km/h (-22.1 mph) at 110 milliseconds into TRG 3.

Event 4 (TRGs 5 and 6)

This event was linked with the side impact to the Infiniti. The maximum longitudinal delta V of this impact was 13.2 km/h (8.2 mph) at 139.5 milliseconds into TRG 6 and a maximum lateral delta V of -10.8 km/h (-6.7 mph) at 160 milliseconds into TRG 6.

Occupant Data

The Toyota was driven by a 23-year-old male who was belted at the time of the crash and received police-reported incapacitating (A-level) injuries. He was transported by ambulance to a Level I trauma center. The extent of his injuries and treatment are unknown.

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2009 Infiniti G37X

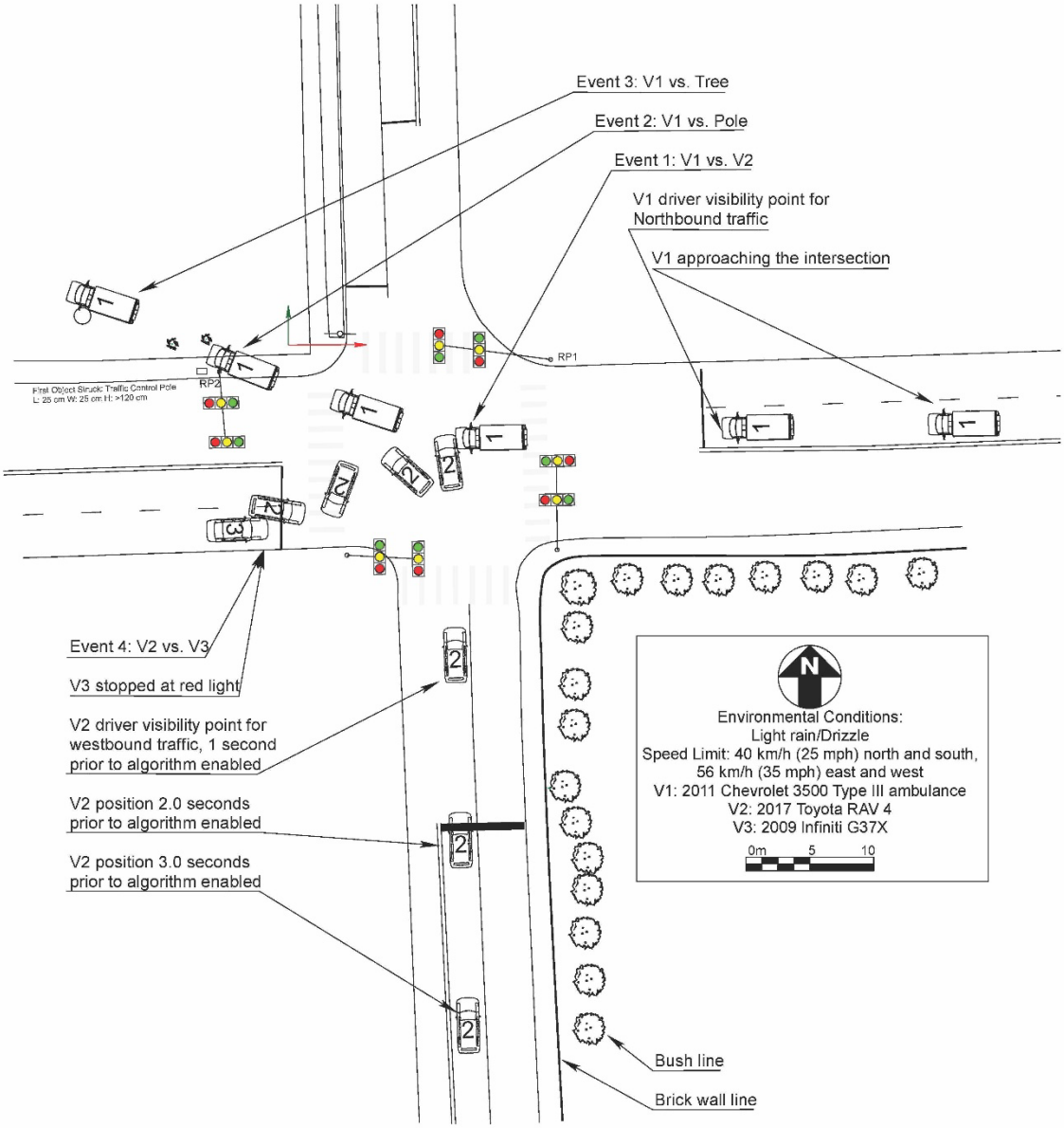
Description

According to the police report, the stationary 2009 Infiniti G37X had disabling damage with an impact at the 11 o'clock sector from the Toyota. The Infiniti was towed from the scene but was released prior to the SCI investigation and was not available for inspection.

Occupant Data

According to the police report, the belted 25-year-old male driver was uninjured and was not transported after the crash events.

Crash Diagram: Overview



	NHTSA
Case Number:	CR22020

Appendix A: 2011 Chevrolet Silverado 3500 Type III Ambulance Event Data Recorder Report[4]

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

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

CDR File Information

User Entered VIN	1GB3C0CL4BF******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	CR22020 V1 ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 23.0.2
Imaged with Software Licensed to (Company Name)	Company Name information was removed when this file was saved without VIN sequence number
Reported with CDR version	Crash Data Retrieval Tool 23.0.2
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	NONE

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:

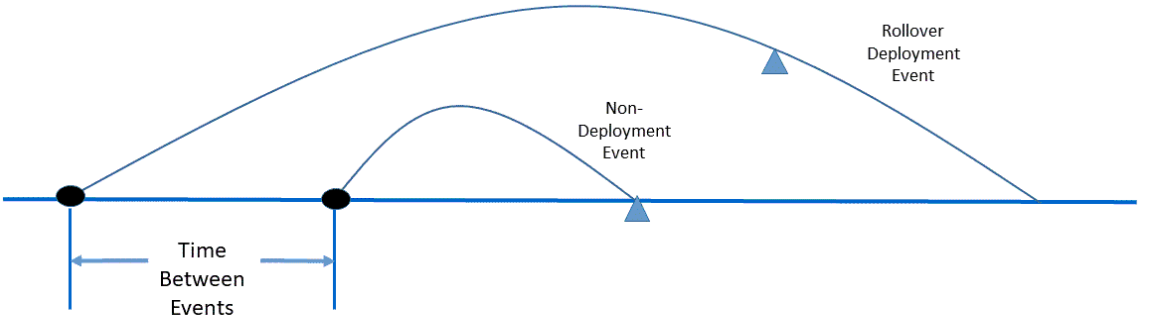
-Pretensioner(s) only Deployment
-Head Rest Deployment
-Battery Cut-Off Deployment

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 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.
For Rollover Events, the SDM may record Lateral 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 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.
-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 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. The 0.5 second Pre-crash data value (most recent recorded data point) is the data point last sampled before AE. That is to say, the last data point may have been captured just before AE but no more than 0.5 second before AE. All subsequent Pre-crash data values are referenced from this data point.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if:
-The SDM receives a message with an "invalid" flag from the module sending the pre-crash data
-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 engines.
-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.
-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.



Event Recor #1	Event Record #2
Event Record Type = Non – Deployment	Event Record Type = Rollover
Concurrent Event Flag = No	Concurrent Event Flag = Yes
Time Between Events = NA	Time Between Events = XX seconds

-The reported range of the longitudinal and lateral acceleration values is approximately ± 50 g.
-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.

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

Data Element Name	Positive Sign Notation Indicates
Longitudinal Velocity Change	Forward
Lateral Acceleration	Left to Right
Lateral Velocity Change	Left to Right
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.

01045_SDM11i-delphi_r018

Event Data (General)

Ignition Cycles At Investigation	25672
ESS # 1 Traceability Data	??000000000000000
ESS # 2 Traceability Data	??000000000000000
ESS # 3 Traceability Data	AD000000000000000
ESS # 4 Traceability Data	??000000000000000
ESS # 5 Traceability Data	??000000000000000
ESS # 6 Traceability Data	??000000000000000
ESS # 7 Traceability Data	??000000000000000
ESS # 8 Traceability Data	??000000000000000
Dynamic Deployment Event Counter	Data Not Available
Dynamic Event Counter	Data Not Available
Dynamic OnStar Notification Event Counter	Data Not Available
Vehicle Identification Number	?GB3C0CL4BF******
System Type	Delphi
Manufacturing Traceability Data	AS8409KY03435UCH
Software Module Identifier 1	00CF38A1
Software Module Identifier 2	015D0D1C
Software Module Identifier 3	01AE4BE4
End Model Part Number	00CF30A9

Hexadecimal Data

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DPID $15
01 02 22 22 05 06 22

DPID $16
22 22 22 22 22 22 22

DPID $17
22 22 22 22 00 00 00

DPID $32
00 FF 64 48 00 00 00

DPID $35
78 00 00 00 00 00 00

DID $01
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DID $05
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DID $0F
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DID $9A
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DID $B4
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DID $C3
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DID $CB
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DID $31

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 0300   FF FF FF FF FF FF FF FF FF FF
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 0460   FF FF FF FF FF FF FF FF FF FF
 0470   FF FF FF FF FF FF FF FF FF FF
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 0490   FF FF FF FF FF FF FF FF FF FF

DID $33

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 0050   FF FF FF FF FF FF FF FF FF FF
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 0120   FF FF FF FF FF FF FF FF FF FF
 0130   FF FF FF FF FF FF FF FF FF FF
 0140   FF FF FF FF FF FF FF FF FF FF
 0150   FF FF FF FF FF FF FF FF FF FF
 0160   FF FF FF FF FF FF FF FF FF FF
 0170   FF FF FF FF FF FF FF FF FF FF
 0180   FF FF FF FF FF FF FF FF FF FF
 0190   FF FF FF FF FF FF FF FF FF FF
 0200   FF FF FF FF FF FF FF FF FF FF
 0210   FF FF FF FF FF FF FF FF FF FF
 0220   FF FF FF FF FF FF FF FF FF FF
```

```
0230   FF FF FF FF FF FF FF FF FF FF
0240   FF FF FF FF FF FF FF FF FF FF
0250   FF FF FF FF FF FF FF FF FF FF
0260   FF FF FF FF FF FF FF FF FF FF
0270   FF FF FF FF FF FF FF FF FF FF
0280   FF FF FF FF FF FF FF FF FF FF
0290   FF FF FF FF FF FF FF FF FF FF
0300   FF FF FF FF FF FF FF FF FF FF
0310   FF FF FF FF FF FF FF FF FF FF
0320   FF FF FF FF FF FF FF FF FF FF
0330   FF FF FF FF FF FF FF FF FF FF
0340   FF FF FF FF FF FF FF FF FF FF
0350   FF FF FF FF FF FF FF FF FF FF
0360   FF FF FF FF FF FF FF FF FF FF
0370   FF FF FF FF FF FF FF FF FF FF
0380   FF FF FF FF FF FF FF FF FF FF
0390   FF FF FF FF FF FF FF FF FF FF
0400   FF FF FF FF FF FF FF FF FF FF
0410   FF FF FF FF FF FF FF FF FF FF
0420   FF FF FF FF FF FF FF FF FF FF
0430   FF FF FF FF FF FF FF FF FF FF
0440   FF FF FF FF FF FF FF FF FF FF
0450   FF FF FF FF FF FF FF FF FF FF
0460   FF FF FF FF FF FF FF FF FF FF
0470   FF FF FF FF FF FF FF FF FF FF
0480   FF FF FF FF FF FF FF FF FF FF
0490   FF FF FF FF FF FF FF FF FF FF
```

Disclaimer of Liability

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

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Appendix B: 2017 Toyota RAV4 Event Data Recorder Report[5]

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

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

CDR File Information

User Entered VIN/Frame Number	2T3DFREVXHWxxxxxx
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 23.0.2
Imaged with Software Licensed to (Company Name)	
Reported with CDR version	Crash Data Retrieval Tool 23.0.2
Reported with Software Licensed to (Company Name)	
EDR Device Type	Airbag Control Module
Event(s) recovered	Front/Rear (2), Side (2), Rollover (2)

Comments

BENCHTOP DOWNLOAD

Data Limitations

CDR Record Information:

- Due to limitations of the data recorded by the airbag ECU, such as the resolution, data range, sampling interval, time period of the recording, and the items recorded, the information provided by this data may not be sufficient to capture the entire crash.
- Pre-Crash data is recorded in discrete intervals. Due to different refresh rates within the vehicle's electronics, the data recorded may not be synchronous to each other.
- Airbag ECU data should be used in conjunction with other physical evidence obtained from the vehicle and the surrounding circumstances.
- If any of the front passenger seat airbags, side airbags, or Curtain Shield Airbags have deployed, data will not be overwritten or deleted by the airbag ECU following that event. If none of the airbags have deployed, the data of that event may be overwritten by a following event even if other airbags (pretensioner, rear seat airbag, etc.) have deployed.
- If power supply to the airbag ECU is lost during an event, all or part of the data may not be recorded.
- "Diagnostic Trouble Codes" are information about faults when a recording trigger is established. Various diagnostic trouble codes could be set and recorded due to component or system damage during an accident.
- The airbag ECU records only diagnostic information related to the airbag system. It does not record diagnostic information related to other vehicle systems.
- The TaSCAN, Global Tech Stream, or Intelligent Tester II devices (or any other Toyota genuine diagnostic tool) can be used to obtain detailed information on the diagnostic trouble codes from the airbag system, as well as diagnostic information from other systems. However, in some cases, the diagnostic trouble codes of the airbag system recorded by the airbag ECU when the event occurred may not match the diagnostic trouble codes read out when the diagnostic tool is used.

General Information:

- The data recording specifications of Toyota's airbag ECUs are divided into the following categories. The specifications for 12EDR or later are designed to be compatible with NHTSA's 49CFR Part 563 rule.
  - 00EDR / 02EDR / 04EDR / 06EDR / 10EDR / 12EDR / 13EDR / 15EDR / 17EDR / 19EDR / 21EDR / 22EDR
- The airbag ECU records data for all or some of the following accident types: frontal crash, rear crash , side crash, and rollover events. Depending on the installed airbag ECU, data for side crash and/or rollover events may not be recorded.
- This airbag ECU records record pre-crash data and post-crash data.
  - If a single event occurs independently, the data for that event is recorded on a one-to-one basis.
  - If multiple events occur successively (within a period of approximately 500ms), the establishment of the recording trigger for the first event is defined as the "pre-crash recording trigger". Pre-crash data for the first event and post-crash data for each successive event is then recorded.
- The airbag ECU has two recording pages (memory maps) to store pre-crash data. Additionally, to store post-crash data, the airbag ECU has two recording pages for each accident type: two pages for frontal and rear crash, two pages for a side crash, and two pages for rollover event.
- The data recorded by the airbag ECU includes correlating information between each previously occurring event (i.e., information that clarifies the collision event sequence. This correlation information consists of the following items.
  - Time from Previous Pre-Crash TRG
  - Linked Pre-Crash Page
  - Time from Pre-Crash TRG
  - TRG Count

- Previous Crash Type

- In frontal and rear collision events, the first point where a longitudinal cumulative delta-V of over 0.8 km/h (0.5 mph) is reached is regarded as time zero for the recorded data. In side impact collision and rollover events, the point in time at which the recording trigger is established is regarded as time zero for the recorded data.
- The recording trigger judgment threshold value differs depending on the collision type (i.e., frontal crash, rear crash, side crash, or rollover event).
- Some of the data recorded by the airbag ECU is transmitted to the airbag ECU from various vehicle control modules by the vehicle's Controller Area Network (CAN).
- In some cases, the airbag ECU part number printed on the ECU label may not match the airbag ECU part number that the CDR tool reports. The part number retrieved by the CDR tool should be considered as the official ECU part number.
- In frontal and rear collision events, the record time varies depending on the period during which a longitudinal cumulative delta-V of over 0.8 km/h (0.5 mph) is reached, and time series data is recorded for up to 250 ms. The record time described above is indicated as "Length of Delta-V". "Delta-V, Longitudinal" outside the record time is indicated by area shaded in the table, and not indicated in the graph.

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.

Data Element Name	Positive Sign Notation Indicates
Maximum Delta-V, Longitudinal	Forward
Delta-V, Longitudinal	Forward
Lateral Acceleration for Frontal/Rear Crash, Floor Sensor	Left to Right
Lateral Acceleration, Side Satellite Sensor 1	Left to Right
Lateral Acceleration, Side Satellite Sensor 2	Left to Right
Lateral Acceleration, Side Satellite Sensor 3	Left to Right
Lateral Acceleration, Side Satellite Sensor 4	Left to Right
Lateral Acceleration for Side Crash, Floor Sensor	Left to Right
Roll Angle Peak	Clockwise Rotation
Roll Angle at the Time of TRG	Clockwise Rotation
Roll Rate	Clockwise Rotation
Lateral Acceleration for Rollover, Floor Sensor	Left to Right
Longitudinal Acceleration , VSC Sensor	Forward
Yaw Rate	Left Turn
Steering Input	Left Turn

Data Definitions:

- The "ON" setting for the "Freeze Signal" indicates a state in which the non-volatile memory can not be overwritten or deleted by the airbag ECU. After "Freeze Signal" has been turned ON, subsequent events will not be recorded.
- "Recording Status" indicates a state in which all recorded event data has been written into the non-volatile memory, or a state in which this process was interrupted and not fully written into the non-volatile memory. If "Recording Status" is "Incomplete", recorded event data may not be valid.
- If the "Occupant Size Classification, Front Passenger" displays "Child" or "Not Occupied", "Side Air Bag Deployment, Time to Deploy" and "Pretensioner Deployment, Time to Fire" may indicate a time even if deployment did not occur on the for following part no's:
  - 89170-07280, 35400, 35410, 35470, 42660, 0R120, 0R080, 0R081, 0R150
- "Engine RPM" indicates the number of engine revolutions, not the number of motor revolutions. The recorded value has an upper limit of 12,800 rpm. Resolution is 100 rpm and the value is rounded down and recorded. For example, if the actual engine speed is 799 rpm, the recorded value will be 700 rpm.
- If the electric vehicle is using a calculated/virtual engine RPM for drivetrain control, "Engine RPM" may be recorded, but should not be used during data analysis.
- The upper limit for the recorded "Vehicle Speed" value is 200 km/h (125mph). Resolution is 1km/h (0.6mph) and the value is rounded down and recorded. The accuracy of the "Vehicle Speed" value can be affected by various factors. These include, but not limited, to the following.
  - Significant changes in the tire's rolling radius
  - Wheel lock and wheel slip
- "Accelerator Pedal" has two recording specifications. Both the recorded value increases as the driver depresses the accelerator.
  - Percentage of accelerator pedal depressed (recorded as 0-100(%)).
  - Output voltage of accelerator pedal module (recorded as 0-5(V)).
- If M/T transmission vehicle of some limited model, "Shift Position" may display "Drive" regardless of the actual shift position.
- Depending on the type of occupant sensor installed in the vehicle, one of the following three recording formats for "Occupant Size Classification, Front Passenger" will be utilized.
  - Occupied / Not Occupied
  - AM50 / AF05 / Child / Not Occupied
  - AM50 / AF05 / Child or Not Occupied
- "Cruise Control Status" indicates whether the cruise control system is actuated or not. OFF indicates that the cruise control system is not actuated, but can also indicates that the vehicle is not equipped with the system.
- "Air Bag Warning Lamp, On/Off", "Ignition Cycle, Crash", "Seat Track Position Switch, Foremost, Status, Driver", "Occupant Size Classification, Front Passenger", "Safety Belt Status, Driver", "Safety Belt Status, Front Passenger", "Frontal Air Bag Suppression Switch Status, Front Passenger", and "RSCA Disable Switch" indicate the state approximately 1 second before time zero. They may not always indicate the state at the moment of collision.
- The upper and lower limits for the recorded value of "Motor RPM" is 17,500 rpm and -7,500 rpm respectively. Resolution is 100 rpm and the value is rounded down and recorded.
- "Brake Oil Pressure" has an upper limit of 12.14 Mpa. In the case of the vehicle that has not VSC system, "0 Mpa" or "Invalid" may be displayed.
- "Longitudinal Acceleration , VSC Sensor" has upper and lower limits for the recorded value of 8.973 m/s^2 and -8.973 m/s^2 respectively. This

acceleration sensor does not sense collisions.

- "Sequential Shift Range" displaying "Undetermined" indicates the shift range is undetermined or was not being used.
- Some vehicles will not be equipped with all "Drive Mode" types indicated in the "Drive Mode" table. If some or all drive modes are not applicable to vehicle, "OFF" or "Invalid" may be displayed. The item in the "Drive Mode" table may not match the name of switch or indicator that equipped the vehicle.
- The upper and lower limits for the recorded value of "Steering Input" is 375 deg and -375 deg respectively. Resolution is 1.5 deg and the value is rounded down and recorded.
- Resolution of the "Air Bag Warning Lamp ON Time Since DTC was Set" is 15 minutes, and the value is rounded down and recorded.
- "Delta-V, Longitudinal" indicates the change in forward speed after time zero. This does not refer to vehicle speed, and it does not include the change in speed during the period from the start of the actual collision to establishment of the time zero.
- "Location of Side Satellite Sensor" shows the outline of a typical sensor position. Sensory location can be confirmed using the repair manual.
- "Time from Previous Pre-Crash TRG" indicates the time between the establishment of an event's pre-crash recording trigger to the establishment of a more recent event's pre-crash recording trigger. The upper limit for the recorded value is 16,381 milliseconds. In the event of establishment of the first pre-crash recording trigger after the ignition is switched ON, the upper limit value(max value) is recorded.
- "TRG Count" indicates a calculated value of the number of times recording triggers have been established for all crash types. The sequence in which each event occurred can be verified from the "TRG Count". The smaller the "TRG Count" value, the older the data. The upper limit for the recorded value is 65,533 times. When more than one event reaches the upper limit, the actual "TRG Count" may be greater than what is displayed for that event.
- "Linked Pre-Crash Page" is used to link 'paged" pre-crash data with 'paged" post-crash data. When old pre-crash data is overwritten by new pre-crash data, the "Linked Pre-Crash Page" value may record a page number that is not actually linked.
- Resolution of the "Time from Pre-Crash to TRG" is 50 [ms], and the value is rounded up and recorded.
- "Roll Angle at the Time of TRG" and "Roll Angle Peak" do not represent the actual roll angle of the vehicle. These values are used internally by the airbag ECU for sensing a rollover.

05013_ToyotaS00std_r033

System Status at Time of Retrieval

ECU Part Number	89170-0R191
EDR Generation	13EDR
Complete File Recorded	No
Freeze Signal	ON
Freeze Signal Factor	Front Airbag Deployment
Diagnostic Trouble Codes Exist	No
Ignition Cycle ,Download (times)	5235
Multi-event, number of events (times)	2 or greater
Time from event 1 to 2 (s)	-0.003
Time from Previous Pre Crash TRG (msec)	16381 or greater
Latest Pre-Crash Page	1
Contains Unlinked Pre-Crash Data	Yes

Event Record Summary at Retrieval

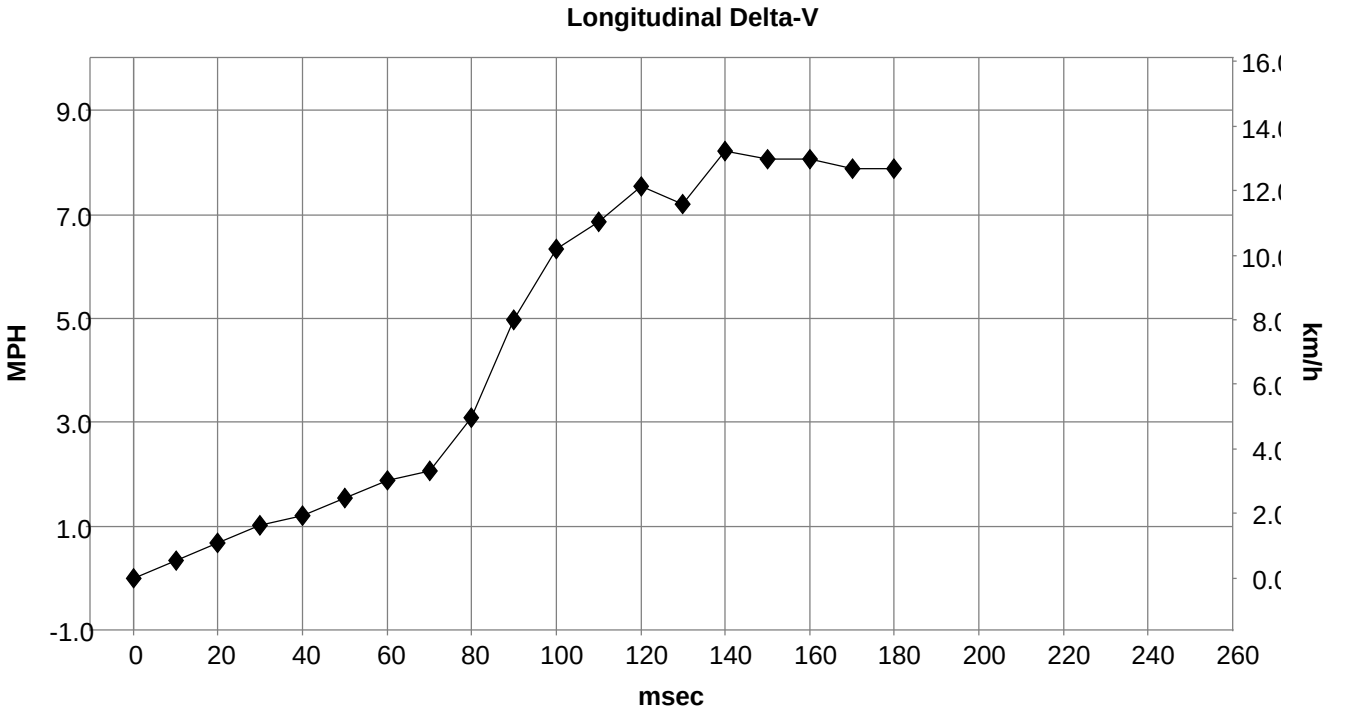
Events Recorded	TRG Count	Crash Type	Time (msec)	Pre-Crash & DTC Data Recording Status	Event & Crash Pulse Data Recording Status
Most Recent Event	6	Front/Rear Crash	0	Complete (Page 1)	Complete (Front/Rear Page 1)
1st Prior Event	5	Side Crash	3	Complete (Page 1)	Complete (Side Page 1)
2nd Prior Event	3	Front/Rear Crash	N/A	N/A	Complete (Front/Rear Page 0)
3rd Prior Event	2	Side Crash	N/A	N/A	Complete (Side Page 0)
4th Prior Event	1	Rollover	N/A	N/A	Complete (Rollover Page 0)
TRG Invalid #1	N/A	Rollover	N/A	N/A	Incomplete (Rollover Page 1)

System Status at Event (Most Recent Event, TRG 6)

Recording Status, Front/Rear Crash Info.	Complete
Crash Type	Front/Rear Crash
TRG Count (times)	6
Previous Crash Type	Side Crash
Time from Pre-Crash TRG (msec)	211
Linked Pre-Crash Page	1
Frontal Airbag Deployment, Time to 1st Stage Deployment, Driver (msec)	No
Frontal Airbag Deployment, Time to 1st Stage Deployment, Front Passenger (msec)	No
Pretensioner Deployment, Time to Fire, Driver (msec)	No
Pretensioner Deployment, Time to Fire, Front Passenger (msec)	No
Frontal Airbag Deployment, Time to 2nd Stage, Driver (msec)	N/A
Frontal Airbag Deployment, Time to 2nd Stage, Front Passenger (msec)	N/A
Active Head Restraint, Time to Deploy, Driver (msec)	SNA
Active Head Restraint, Time to Deploy, Front Passenger (msec)	SNA
Side Curtain Airbag Deployment, Time to Deploy, Driver (msec)	No
Side Curtain Airbag Deployment, Time to Deploy, Passenger (msec)	No
Side Airbag Deployment, Time to Deploy, Driver (msec)	No
Side Airbag Deployment, Time to Deploy, Passenger (msec)	No
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

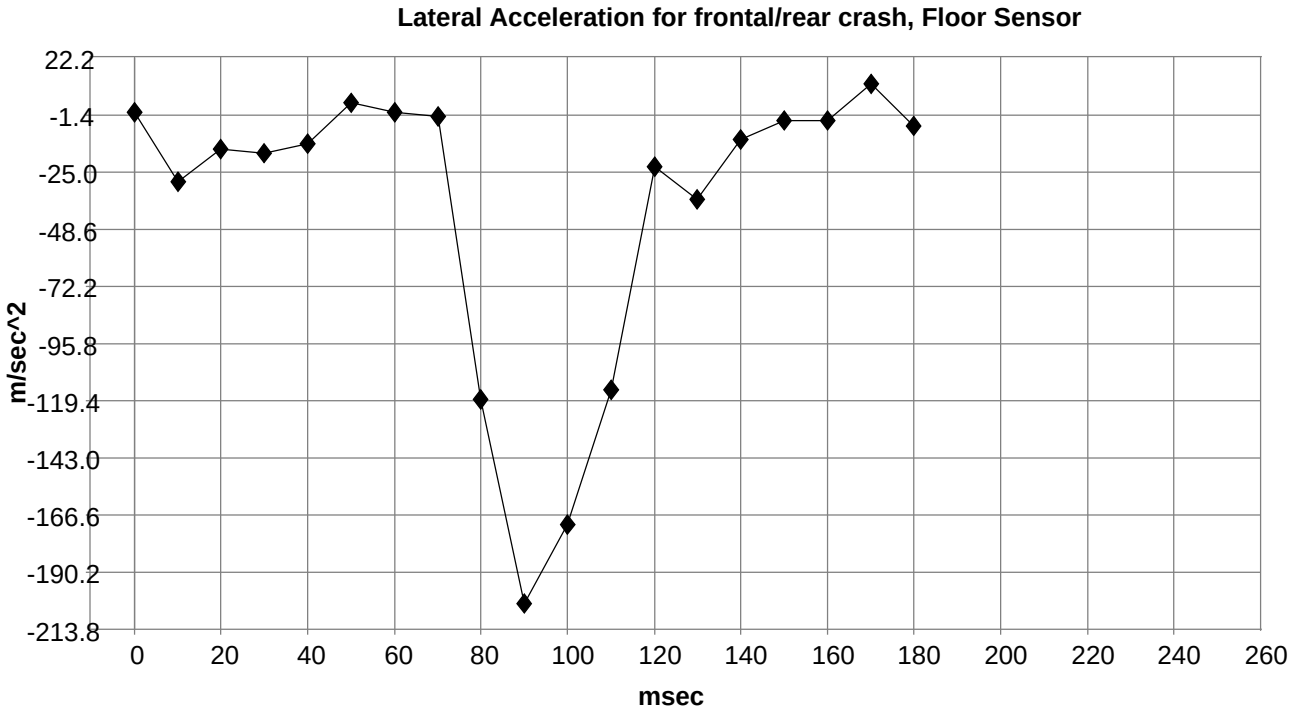
Longitudinal/Lateral Crash Pulse (Most Recent Event, TRG 6 - table 1 of 2)

Recording Status, Time Series Data	Complete
Time from Time Zero to TRG (msec)	92.5
Length of Delta-V (msec)	180
Max. Longitudinal Delta-V (MPH [km/h])	8.2 [13.2]
Time, Maximum Delta-V, Longitudinal (msec)	139.5
Power Supply Status at Max. Delta-V	OFF
Clipping Time of Longitudinal Delta-V (msec)	No
Clipping Time of Lateral Acceleration, Floor Sensor (msec)	79.5



Deployment Time Marker Key

1	Driver Airbag Deployment Time
2	Passenger Airbag Deployment Time
3	Driver/Passenger Pretensioner
4	Driver 2nd Stage Airbag Deployment Time
5	Passenger 2nd Stage Airbag Deployment
6	Driver/Passenger AHR
7	Driver CSA
8	Passenger CSA
9	Rear Window Airbag Deployment Time
10	Driver SAB
11	Passenger SAB



Deployment Time Marker Key

1	Driver Airbag Deployment Time
2	Passenger Airbag Deployment Time
3	Driver/Passenger Pretensioner
4	Driver 2nd Stage Airbag Deployment Time
5	Passenger 2nd Stage Airbag Deployment
6	Driver/Passenger AHR
7	Driver CSA
8	Passenger CSA
9	Rear Window Airbag Deployment Time
10	Driver SAB
11	Passenger SAB

Longitudinal/Lateral Crash Pulse (Most Recent Event, TRG 6 - table 2 of 2)

Time (msec)	Longitudinal Delta-V (MPH [km/h])	Lateral Acceleration for Frontal/Rear Crash, Floor Sensor (m/sec^2)	Power Supply Status
0	0.0 [0.0]	0.0	OFF
10	0.3 [0.6]	-28.7	OFF
20	0.7 [1.1]	-15.3	OFF
30	1.0 [1.7]	-17.2	OFF
40	1.2 [1.9]	-13.4	OFF
50	1.5 [2.5]	3.8	OFF
60	1.9 [3.0]	0.0	OFF
70	2.1 [3.3]	-1.9	OFF
80	3.1 [5.0]	-118.8	OFF
90	5.0 [8.0]	-203.0	OFF
100	6.3 [10.2]	-170.5	OFF
110	6.9 [11.0]	-114.9	OFF
120	7.5 [12.1]	-23.0	OFF
130	7.2 [11.6]	-36.4	OFF
140	8.2 [13.2]	-11.5	OFF
150	8.1 [13.0]	-3.8	OFF
160	8.1 [13.0]	-3.8	OFF
170	7.9 [12.7]	11.5	OFF
180	7.9 [12.7]	-5.7	OFF
190	0.0 [0.0]	0.0	ON
200	0.0 [0.0]	0.0	ON
210	0.0 [0.0]	0.0	ON
220	0.0 [0.0]	0.0	ON
230	0.0 [0.0]	0.0	ON
240	0.0 [0.0]	0.0	ON
250	0.0 [0.0]	0.0	ON

DTCs Present at Time of Event (Most Recent Event, TRG 6)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Airbag Warning Lamp ON Time Since DTC was Set (min)	0
Diagnostic Trouble Codes	None

Pre-Crash Data, 1 Sample (Most Recent Event, TRG 6)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	400
TRG Count when Pre-crash TRG was Established (times)	2
Safety Belt Status, Driver	ON
Safety Belt Status, Front Passenger	OFF
Occupant Size Classification, Front Passenger	Child or Not Occupied
Frontal Airbag Suppression Switch Status, Front Passenger	SNA
RSCA Disable Switch	SNA
Seat Track Position Switch, Foremost, Status, Driver	No
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	5234

Pre-Crash Data, -5 to 0 seconds (Most Recent Event, TRG 6)

Time (sec)	-4.9	-4.4	-3.9	-3.4	-2.9	-2.4	-1.9	-1.4	-0.9	-0.4	0 (TRG)
Vehicle Speed (MPH [km/h])	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.3 [52]
Accelerator Pedal, % Full (%)	3.5	3.5	3.5	3.5	3.0	0.0	0.0	0.0	0.0	8.0	0.0
Percentage of Engine Throttle (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Engine RPM (RPM)	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,300
Motor RPM (RPM)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Service Brake, ON/OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Brake Oil Pressure (Mpa)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Longitudinal Acceleration , VSC Sensor (m/sec^2)	-0.359	-0.431	-0.359	-0.431	-0.431	-0.502	-0.287	-0.359	-0.431	-1.364	-6.388
Yaw Rate (deg/sec)	-0.49	-0.98	-0.98	-0.49	-0.49	-0.49	-0.49	0.00	0.00	1.95	11.71
Steering Input (degrees)	1.5	-1.5	-1.5	-1.5	-1.5	0.0	1.5	1.5	3.0	21.0	72.0
Shift Position	D	D	D	D	D	D	D	D	D	D	D
Sequential Shift Range	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
Cruise Control Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, PWR	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, ECO	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
Drive Mode, Sport	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Snow	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, EV	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

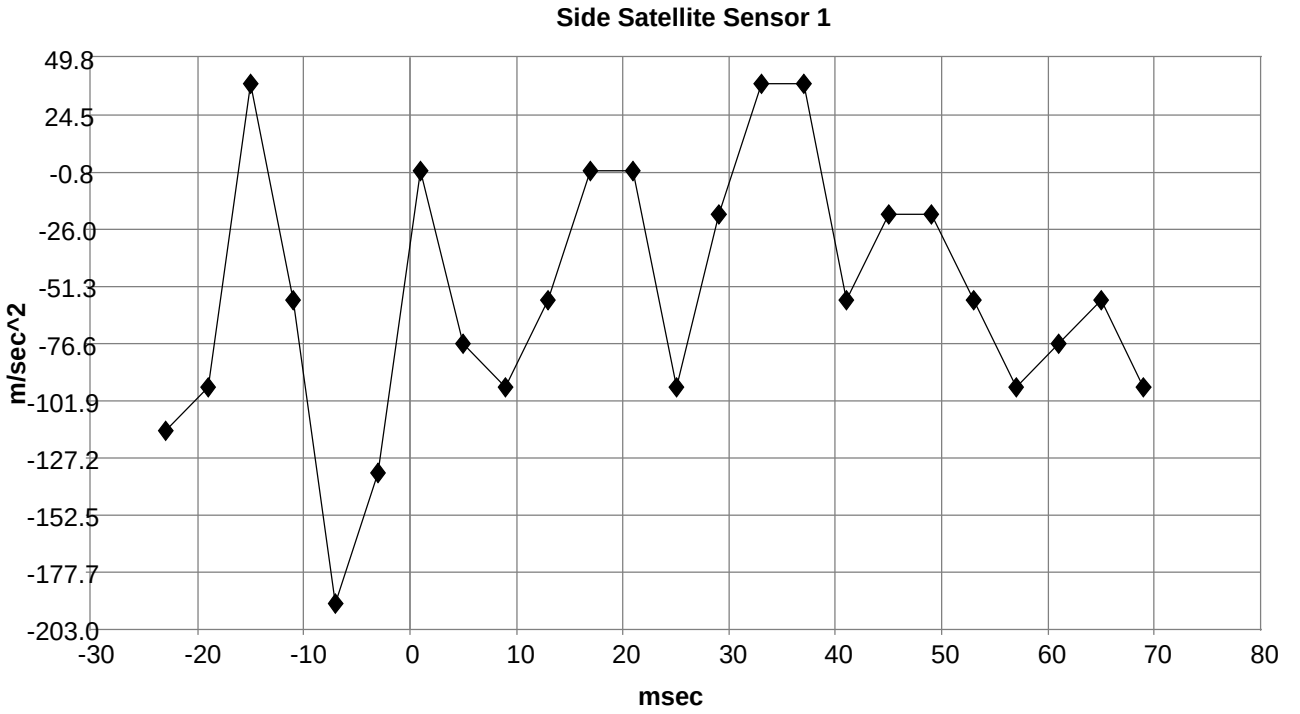
Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

System Status at Event (1st Prior Event, TRG 5)

Recording Status, Side Crash Info.	Complete
Crash Type	Side Crash
TRG Count (times)	5
Previous Crash Type	Rollover
Time from Pre-Crash TRG (msec)	121
Linked Pre-Crash Page	1
Side Airbag Deployment, Time to Deploy (If Equipped) (msec)	No
Side Curtain Airbag Deployment, Time to Deploy (If Equipped) (msec)	No
Pretensioner Deployment, Time to Fire (msec)	No
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

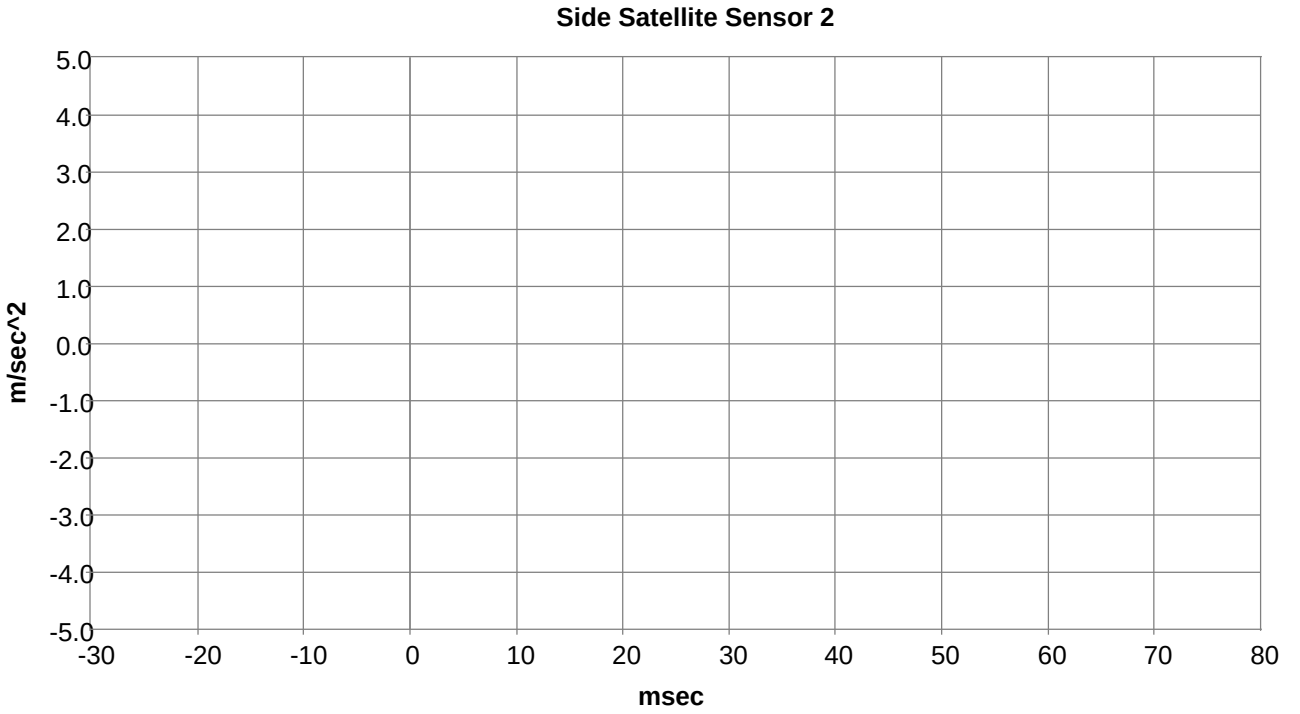
Lateral Crash Pulse (1st Prior Event, TRG 5 - table 1 of 2)

Recording Status, Time Series Data	Complete
Recorded Side	Right Side
Time from TRG to Next Sample (msec)	1
Location of Side Satellite Sensor 1	Front Door
Location of Side Satellite Sensor 2	Not Equipped
Location of Side Satellite Sensor 3	Not Equipped
Location of Side Satellite Sensor 4	C-Pillar
Location of Floor Sensor	Airbag ECU
Clipping Time of Lateral Acceleration, Side Satellite Sensor 1 (msec)	No
Clipping Time of Lateral Acceleration, Side Satellite Sensor 2 (msec)	SNA
Clipping Time of Lateral Acceleration, Side Satellite Sensor 3 (msec)	SNA
Clipping Time of Lateral Acceleration, Side Satellite Sensor 4 (msec)	No
Clipping Time of Lateral Acceleration, Floor Sensor (msec)	No



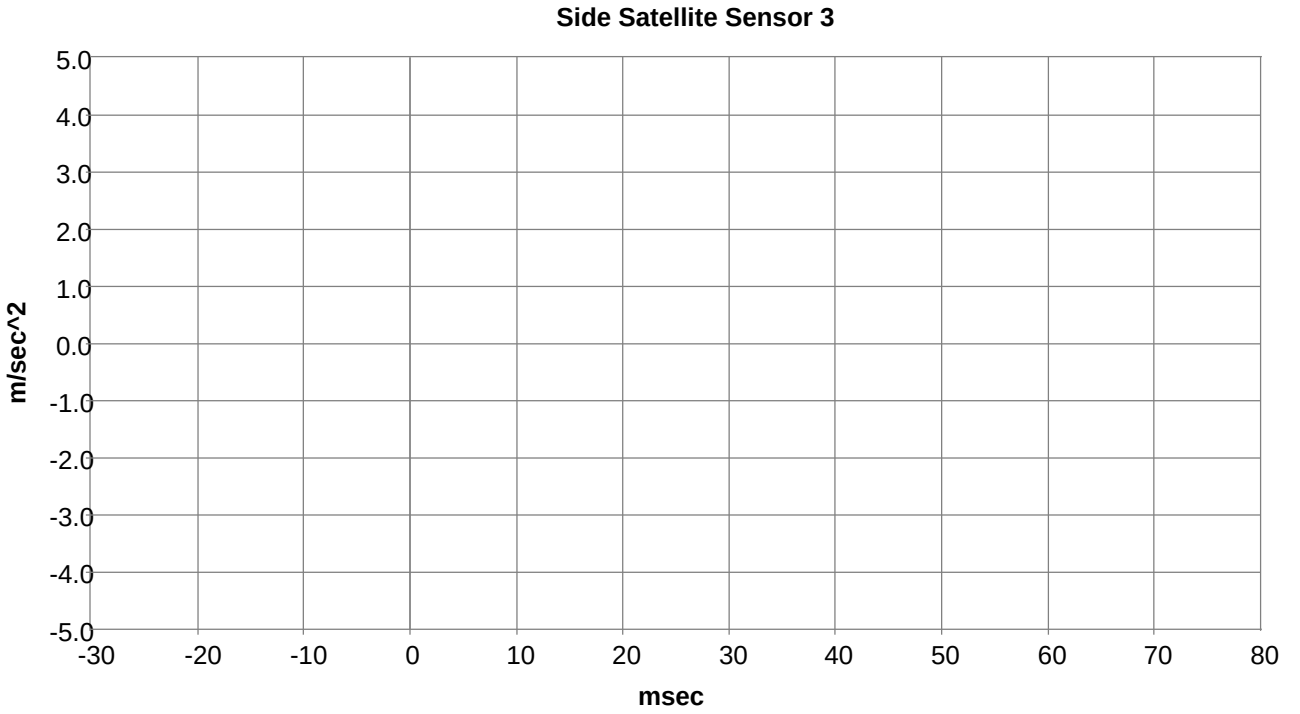
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



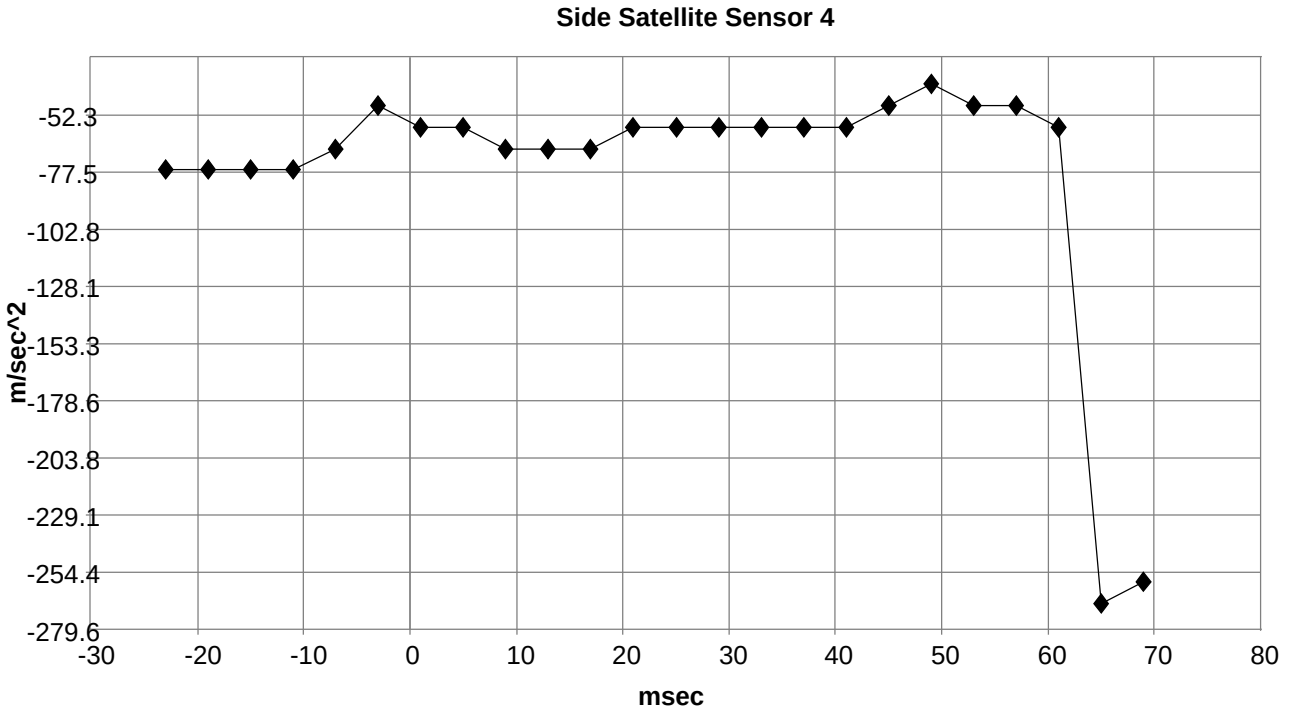
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



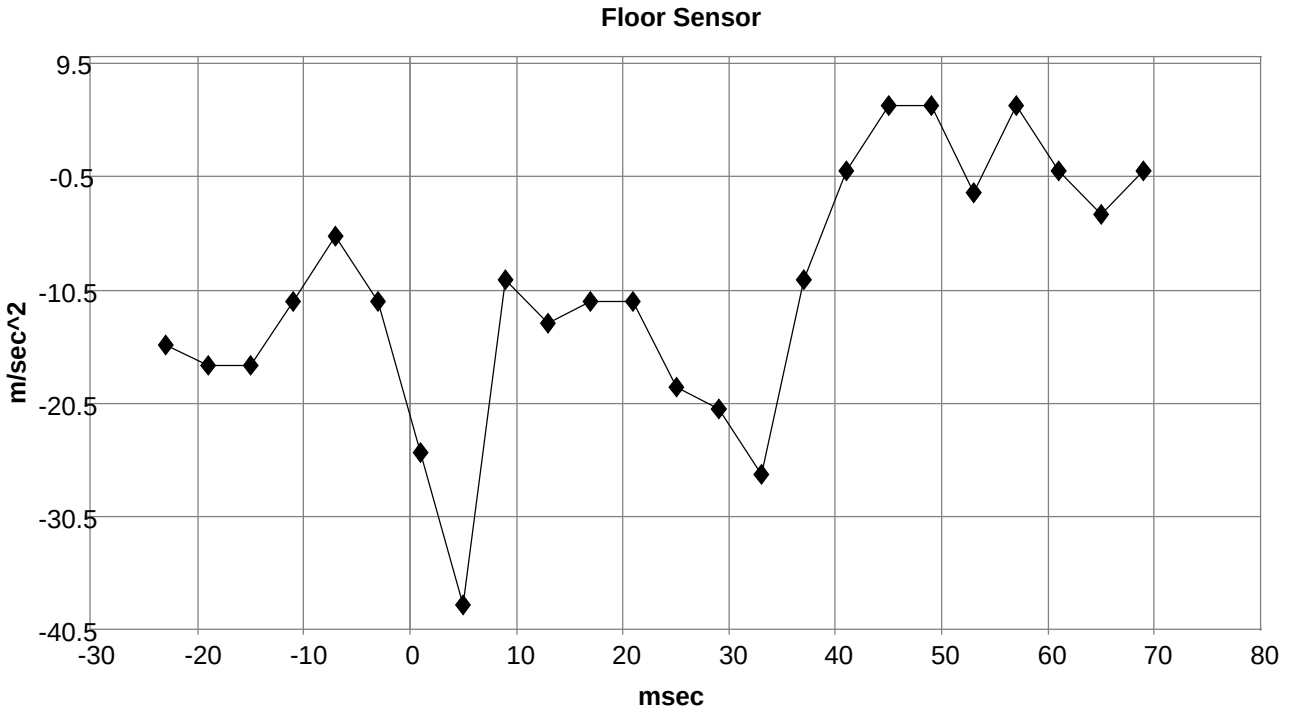
Deployment Time Marker Key

1	Side Curtain Airbag



Deployment Time Marker Key

1	Side Curtain Airbag



Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time
4	Side Curtain Airbag

Lateral Crash Pulse (1st Prior Event, TRG 5 - table 2 of 2)

Time (msec)	Lateral Acceleration, Side Satellite Sensor 1 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 2 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 3 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 4 (m/sec^2)	Lateral Acceleration for Side Crash, Floor Sensor (m/sec^2)
-23	-114.9	SNA	SNA	-76.6	-15.3
-19	-95.8	SNA	SNA	-76.6	-17.2
-15	38.3	SNA	SNA	-76.6	-17.2
-11	-57.5	SNA	SNA	-76.6	-11.5
-7	-191.5	SNA	SNA	-67.0	-5.7
-3	-134.1	SNA	SNA	-47.9	-11.5
1	0.0	SNA	SNA	-57.5	-24.9
5	-76.6	SNA	SNA	-57.5	-38.3
9	-95.8	SNA	SNA	-67.0	-9.6
13	-57.5	SNA	SNA	-67.0	-13.4
17	0.0	SNA	SNA	-67.0	-11.5
21	0.0	SNA	SNA	-57.5	-11.5
25	-95.8	SNA	SNA	-57.5	-19.2
29	-19.2	SNA	SNA	-57.5	-21.1
33	38.3	SNA	SNA	-57.5	-26.8
37	38.3	SNA	SNA	-57.5	-9.6
41	-57.5	SNA	SNA	-57.5	0.0
45	-19.2	SNA	SNA	-47.9	5.7
49	-19.2	SNA	SNA	-38.3	5.7
53	-57.5	SNA	SNA	-47.9	-1.9
57	-95.8	SNA	SNA	-47.9	5.7
61	-76.6	SNA	SNA	-57.5	0.0
65	-57.5	SNA	SNA	-268.2	-3.8
69	-95.8	SNA	SNA	-258.6	0.0

DTCs Present at Time of Event (1st Prior Event, TRG 5)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Airbag Warning Lamp ON Time Since DTC was Set (min)	0
Diagnostic Trouble Codes	None

Pre-Crash Data, 1 Sample (1st Prior Event, TRG 5)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	400
TRG Count when Pre-crash TRG was Established (times)	2
Safety Belt Status, Driver	ON
Safety Belt Status, Front Passenger	OFF
Occupant Size Classification, Front Passenger	Child or Not Occupied
Frontal Airbag Suppression Switch Status, Front Passenger	SNA
RSCA Disable Switch	SNA
Seat Track Position Switch, Foremost, Status, Driver	No
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	5234

Pre-Crash Data, -5 to 0 seconds (1st Prior Event, TRG 5)

Time (sec)	-4.9	-4.4	-3.9	-3.4	-2.9	-2.4	-1.9	-1.4	-0.9	-0.4	0 (TRG)
Vehicle Speed (MPH [km/h])	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.9 [53]	32.3 [52]
Accelerator Pedal, % Full (%)	3.5	3.5	3.5	3.5	3.0	0.0	0.0	0.0	0.0	8.0	0.0
Percentage of Engine Throttle (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Engine RPM (RPM)	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,300
Motor RPM (RPM)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Service Brake, ON/OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Brake Oil Pressure (Mpa)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Longitudinal Acceleration , VSC Sensor (m/sec^2)	-0.359	-0.431	-0.359	-0.431	-0.431	-0.502	-0.287	-0.359	-0.431	-1.364	-6.388
Yaw Rate (deg/sec)	-0.49	-0.98	-0.98	-0.49	-0.49	-0.49	-0.49	0.00	0.00	1.95	11.71
Steering Input (degrees)	1.5	-1.5	-1.5	-1.5	-1.5	0.0	1.5	1.5	3.0	21.0	72.0
Shift Position	D	D	D	D	D	D	D	D	D	D	D
Sequential Shift Range	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
Cruise Control Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, PWR	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, ECO	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
Drive Mode, Sport	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Snow	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, EV	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

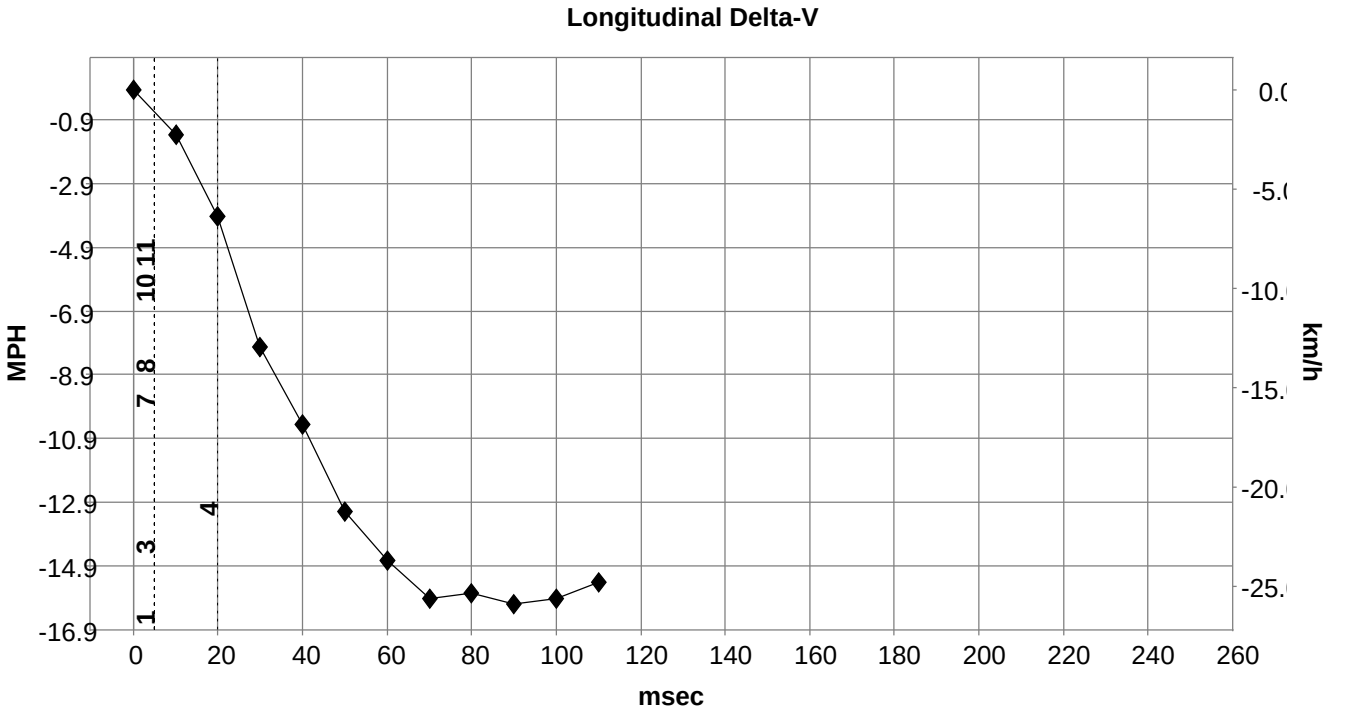
Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

System Status at Event (2nd Prior Event, TRG 3)

Recording Status, Front/Rear Crash Info.	Complete
Crash Type	Front/Rear Crash
TRG Count (times)	3
Previous Crash Type	Side Crash
Time from Pre-Crash TRG (msec)	5
Linked Pre-Crash Page	1
Frontal Airbag Deployment, Time to 1st Stage Deployment, Driver (msec)	5
Frontal Airbag Deployment, Time to 1st Stage Deployment, Front Passenger (msec)	No
Pretensioner Deployment, Time to Fire, Driver (msec)	5
Pretensioner Deployment, Time to Fire, Front Passenger (msec)	5
Frontal Airbag Deployment, Time to 2nd Stage, Driver (msec)	20
Frontal Airbag Deployment, Time to 2nd Stage, Front Passenger (msec)	N/A
Active Head Restraint, Time to Deploy, Driver (msec)	SNA
Active Head Restraint, Time to Deploy, Front Passenger (msec)	SNA
Side Curtain Airbag Deployment, Time to Deploy, Driver (msec)	5
Side Curtain Airbag Deployment, Time to Deploy, Passenger (msec)	5
Side Airbag Deployment, Time to Deploy, Driver (msec)	5
Side Airbag Deployment, Time to Deploy, Passenger (msec)	5
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

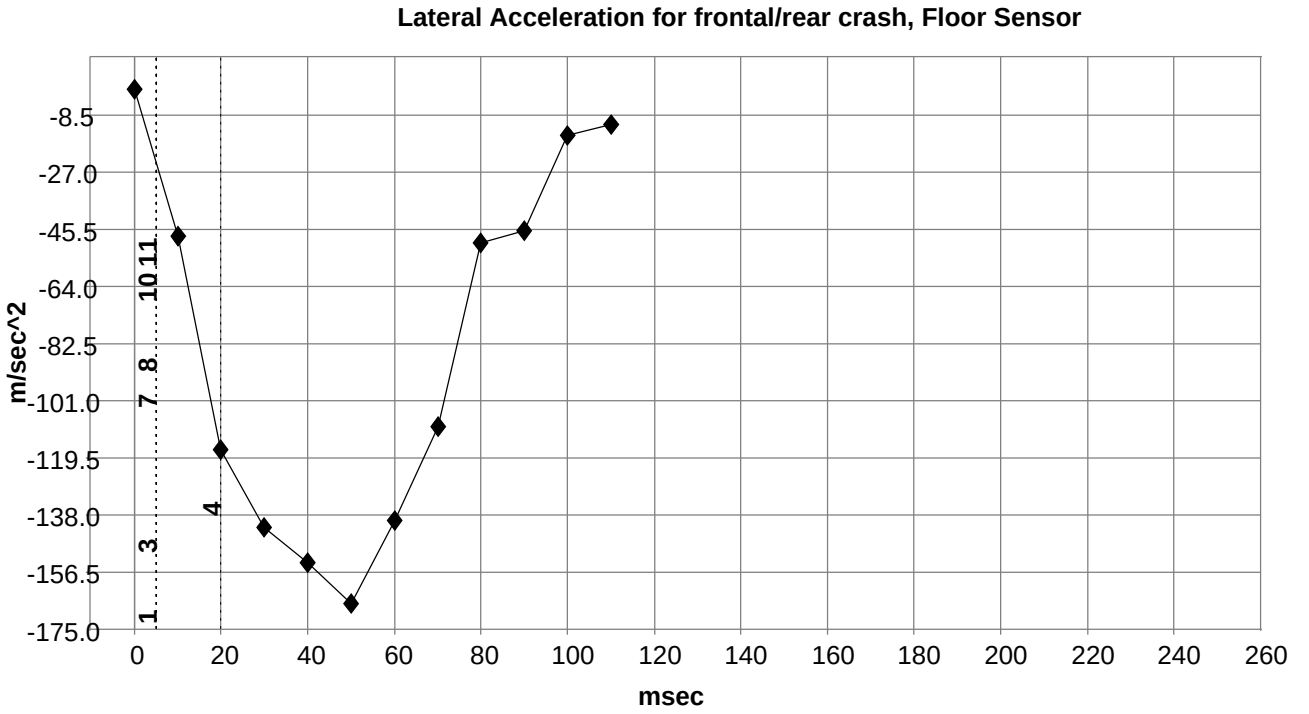
Longitudinal/Lateral Crash Pulse (2nd Prior Event, TRG 3 - table 1 of 2)

Recording Status, Time Series Data	Complete
Time from Time Zero to TRG (msec)	5.0
Length of Delta-V (msec)	110
Max. Longitudinal Delta-V (MPH [km/h])	-16.3 [-26.2]
Time, Maximum Delta-V, Longitudinal (msec)	91.0
Power Supply Status at Max. Delta-V	OFF
Clipping Time of Longitudinal Delta-V (msec)	No
Clipping Time of Lateral Acceleration, Floor Sensor (msec)	7.0



Deployment Time Marker Key

1	Driver Airbag Deployment Time
2	Passenger Airbag Deployment Time
3	Driver/Passenger Pretensioner
4	Driver 2nd Stage Airbag Deployment Time
5	Passenger 2nd Stage Airbag Deployment
6	Driver/Passenger AHR
7	Driver CSA
8	Passenger CSA
9	Rear Window Airbag Deployment Time
10	Driver SAB
11	Passenger SAB



Deployment Time Marker Key

1	Driver Airbag Deployment Time
2	Passenger Airbag Deployment Time
3	Driver/Passenger Pretensioner
4	Driver 2nd Stage Airbag Deployment Time
5	Passenger 2nd Stage Airbag Deployment
6	Driver/Passenger AHR
7	Driver CSA
8	Passenger CSA
9	Rear Window Airbag Deployment Time
10	Driver SAB
11	Passenger SAB

Longitudinal/Lateral Crash Pulse (2nd Prior Event, TRG 3 - table 2 of 2)

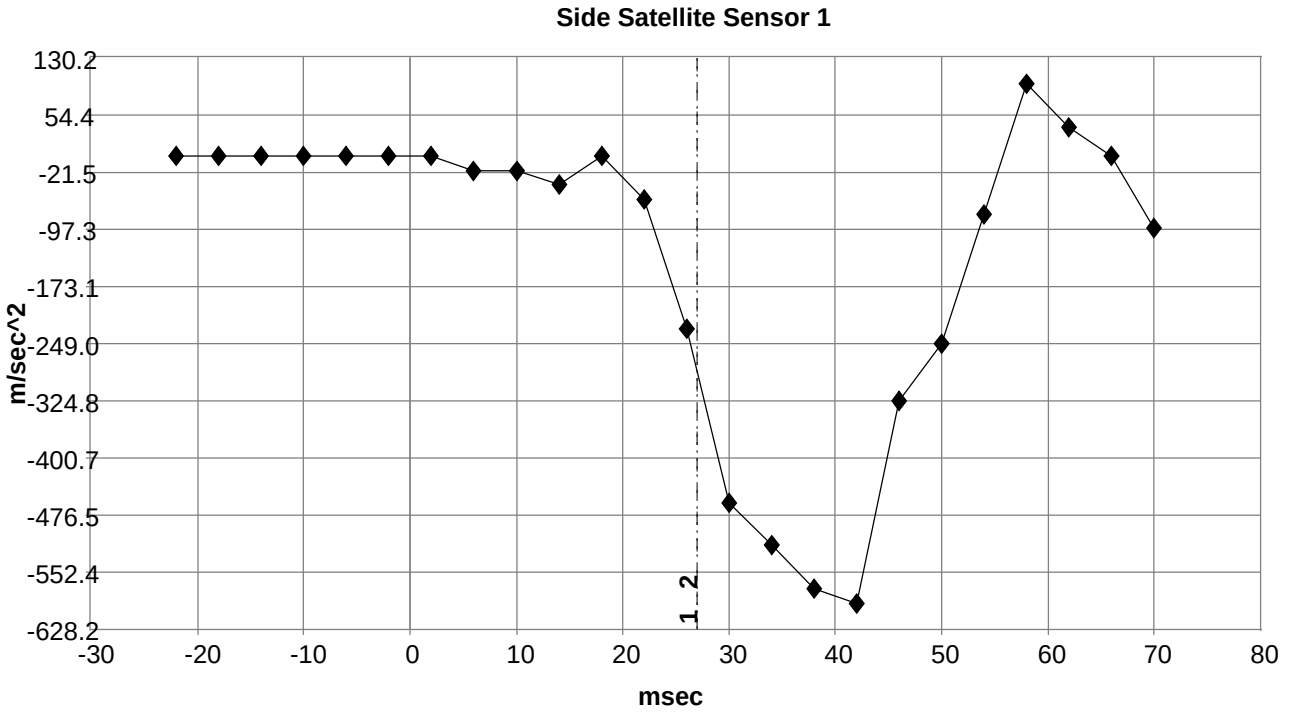
Time (msec)	Longitudinal Delta-V (MPH [km/h])	Lateral Acceleration for Frontal/Rear Crash, Floor Sensor (m/sec^2)	Power Supply Status
0	0.0 [0.0]	0.0	ON
10	-1.4 [-2.2]	-47.9	ON
20	-3.9 [-6.3]	-116.8	ON
30	-8.1 [-13.0]	-141.7	ON
40	-10.5 [-16.8]	-153.2	OFF
50	-13.2 [-21.2]	-166.6	OFF
60	-14.7 [-23.7]	-139.8	OFF
70	-15.9 [-25.7]	-109.2	OFF
80	-15.8 [-25.4]	-49.8	OFF
90	-16.1 [-25.9]	-46.0	OFF
100	-15.9 [-25.7]	-15.3	OFF
110	-15.4 [-24.8]	-11.5	OFF
120	0.0 [0.0]	0.0	ON
130	0.0 [0.0]	0.0	ON
140	0.0 [0.0]	0.0	ON
150	0.0 [0.0]	0.0	ON
160	0.0 [0.0]	0.0	ON
170	0.0 [0.0]	0.0	ON
180	0.0 [0.0]	0.0	ON
190	0.0 [0.0]	0.0	ON
200	0.0 [0.0]	0.0	ON
210	0.0 [0.0]	0.0	ON
220	0.0 [0.0]	0.0	ON
230	0.0 [0.0]	0.0	ON
240	0.0 [0.0]	0.0	ON
250	0.0 [0.0]	0.0	ON

System Status at Event (3rd Prior Event, TRG 2)

Recording Status, Side Crash Info.	Complete
Crash Type	Side Crash
TRG Count (times)	2
Previous Crash Type	No Event
Time from Pre-Crash TRG (msec)	0
Linked Pre-Crash Page	1
Side Airbag Deployment, Time to Deploy (If Equipped) (msec)	27
Side Curtain Airbag Deployment, Time to Deploy (If Equipped) (msec)	27
Pretensioner Deployment, Time to Fire (msec)	27
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

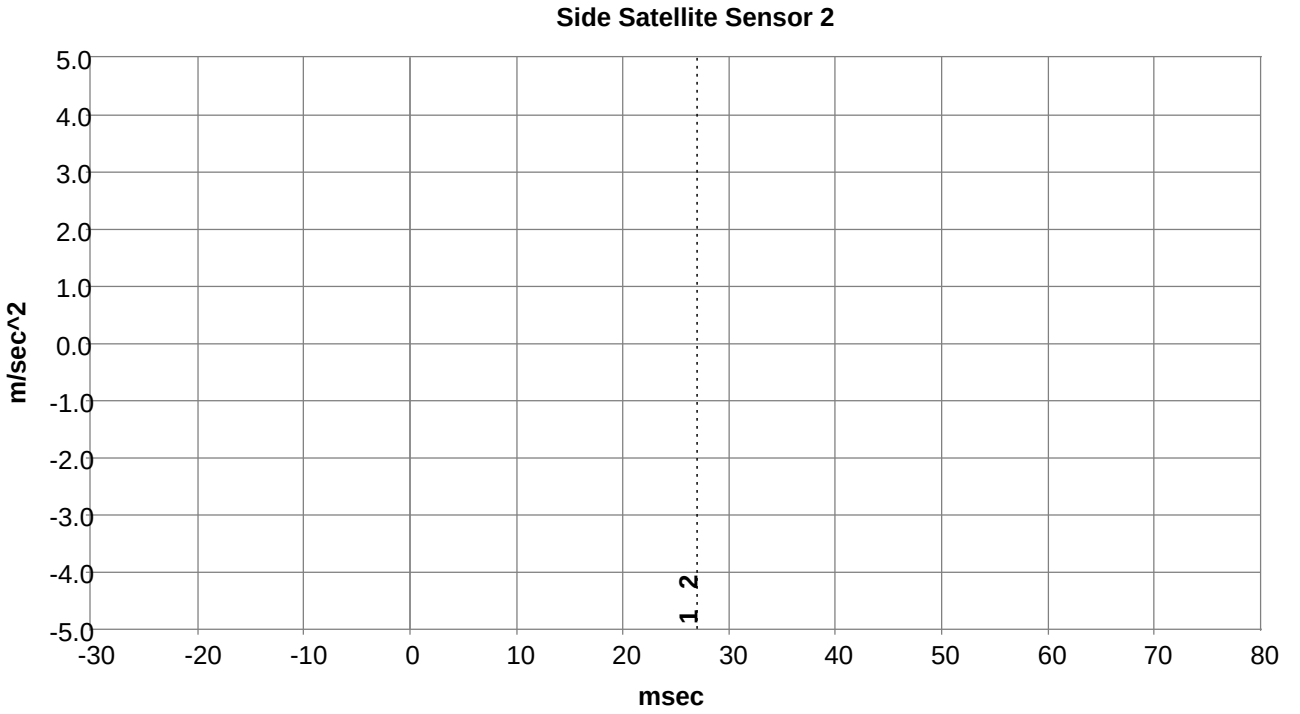
Lateral Crash Pulse (3rd Prior Event, TRG 2 - table 1 of 2)

Recording Status, Time Series Data	Complete
Recorded Side	Right Side
Time from TRG to Next Sample (msec)	2
Location of Side Satellite Sensor 1	Front Door
Location of Side Satellite Sensor 2	Not Equipped
Location of Side Satellite Sensor 3	Not Equipped
Location of Side Satellite Sensor 4	C-Pillar
Location of Floor Sensor	Airbag ECU
Clipping Time of Lateral Acceleration, Side Satellite Sensor 1 (msec)	No
Clipping Time of Lateral Acceleration, Side Satellite Sensor 2 (msec)	SNA
Clipping Time of Lateral Acceleration, Side Satellite Sensor 3 (msec)	SNA
Clipping Time of Lateral Acceleration, Side Satellite Sensor 4 (msec)	No
Clipping Time of Lateral Acceleration, Floor Sensor (msec)	7.5



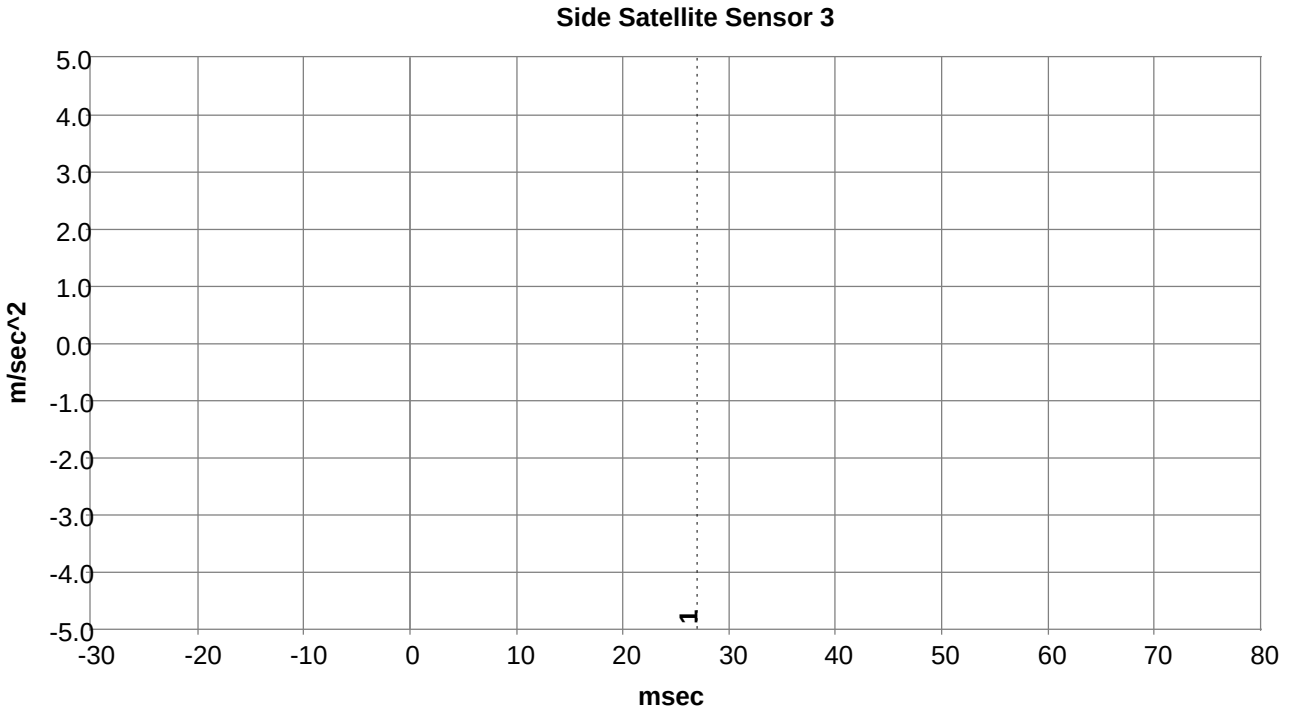
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



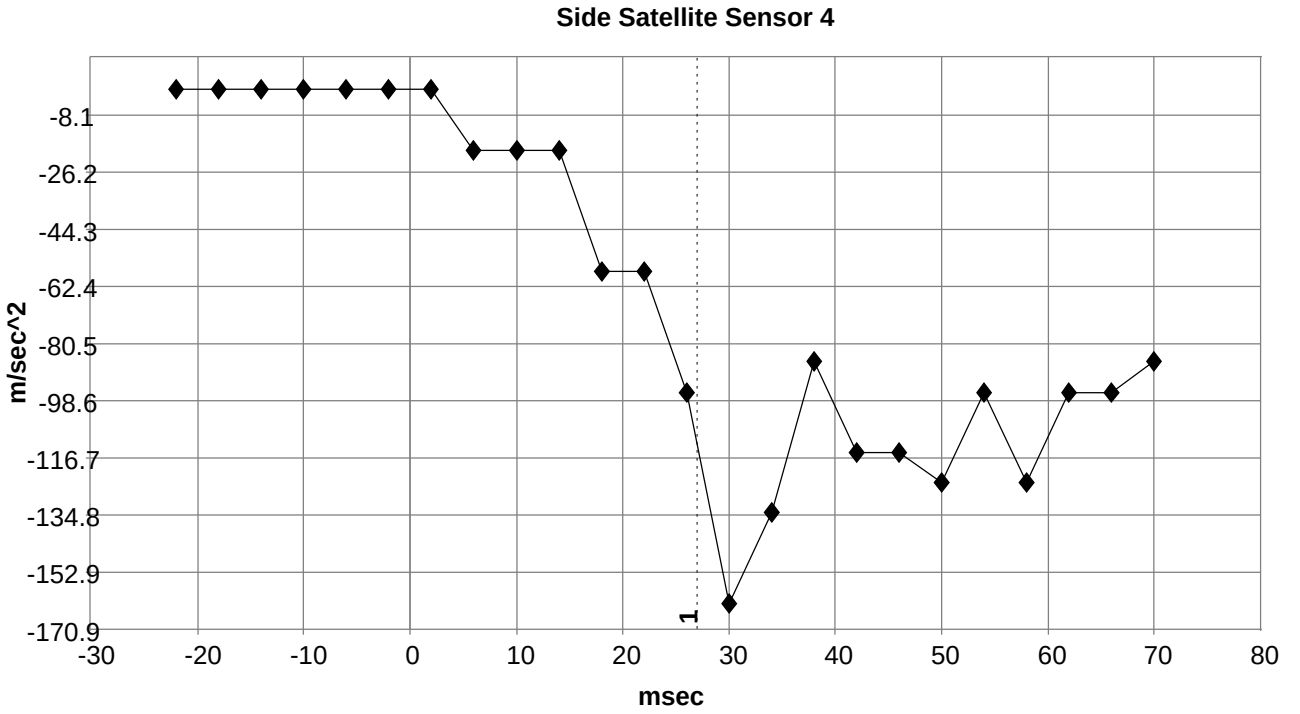
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



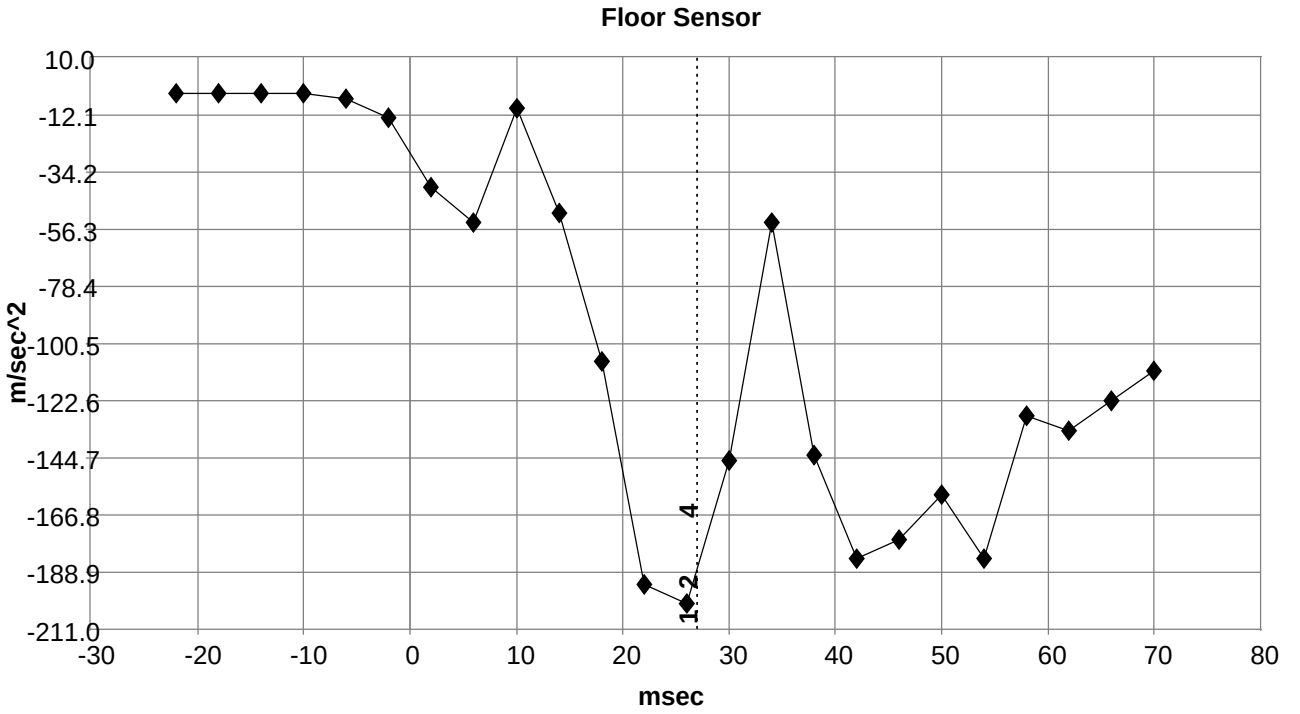
Deployment Time Marker Key

1	Side Curtain Airbag



Deployment Time Marker Key

1	Side Curtain Airbag



Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time
4	Side Curtain Airbag

Lateral Crash Pulse (3rd Prior Event, TRG 2 - table 2 of 2)

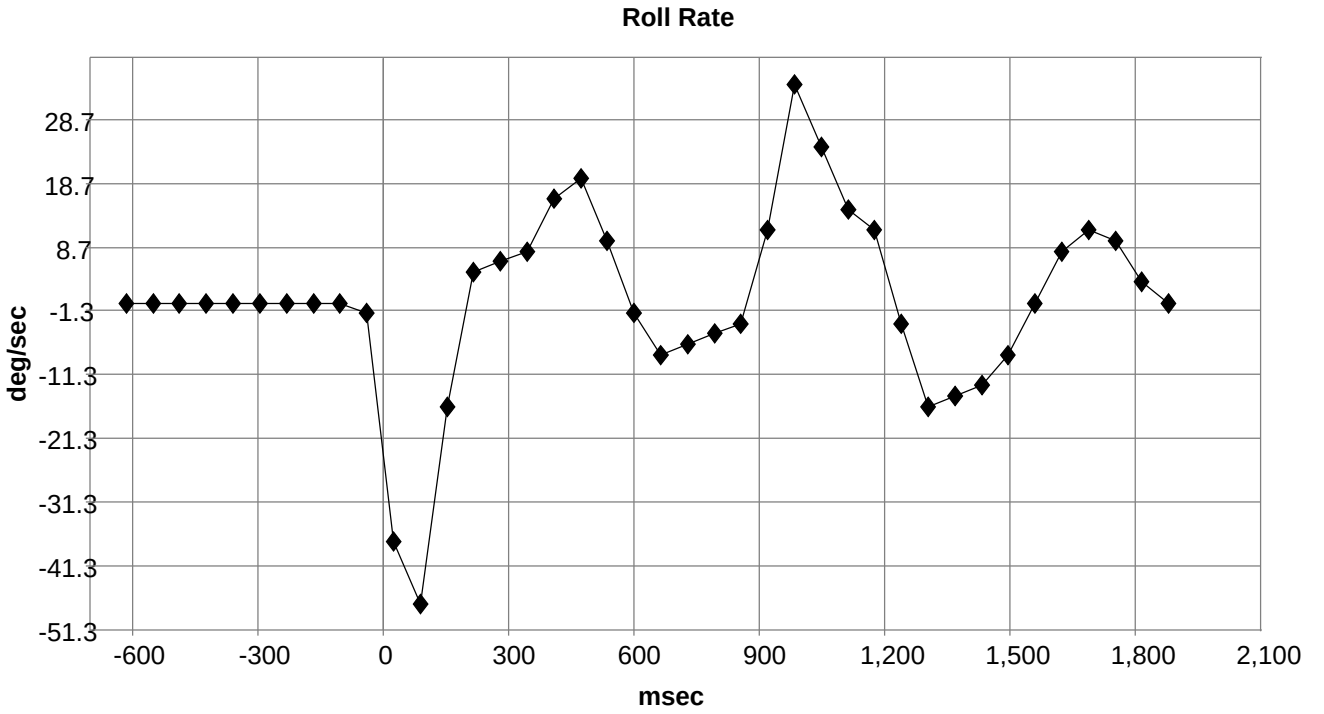
Time (msec)	Lateral Acceleration, Side Satellite Sensor 1 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 2 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 3 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 4 (m/sec^2)	Lateral Acceleration for Side Crash, Floor Sensor (m/sec^2)
-22	0.0	SNA	SNA	0.0	-3.8
-18	0.0	SNA	SNA	0.0	-3.8
-14	0.0	SNA	SNA	0.0	-3.8
-10	0.0	SNA	SNA	0.0	-3.8
-6	0.0	SNA	SNA	0.0	-5.7
-2	0.0	SNA	SNA	0.0	-13.4
2	0.0	SNA	SNA	0.0	-40.2
6	-19.2	SNA	SNA	-19.2	-53.6
10	-19.2	SNA	SNA	-19.2	-9.6
14	-38.3	SNA	SNA	-19.2	-49.8
18	0.0	SNA	SNA	-57.5	-107.3
22	-57.5	SNA	SNA	-57.5	-193.5
26	-229.8	SNA	SNA	-95.8	-201.1
30	-459.7	SNA	SNA	-162.8	-145.6
34	-517.1	SNA	SNA	-134.1	-53.6
38	-574.6	SNA	SNA	-86.2	-143.7
42	-593.8	SNA	SNA	-114.9	-183.9
46	-325.6	SNA	SNA	-114.9	-176.2
50	-249.0	SNA	SNA	-124.5	-159.0
54	-76.6	SNA	SNA	-95.8	-183.9
58	95.8	SNA	SNA	-124.5	-128.3
62	38.3	SNA	SNA	-95.8	-134.1
66	0.0	SNA	SNA	-95.8	-122.6
70	-95.8	SNA	SNA	-86.2	-111.1

System Status at Event (4th Prior Event, TRG 1)

Recording Status, Rollover Crash Info.	Complete
Crash Type	Rollover
TRG Count (times)	1
Previous Crash Type	No Event
Time from Pre-Crash TRG (msec)	0
Linked Pre-Crash Page	0
Side Curtain Airbag Deployment, Time to Deploy (msec)	No
Pretensioner Deployment, Time to Fire, Driver (msec)	No
Pretensioner Deployment, Time to Fire, Front Passenger (msec)	No

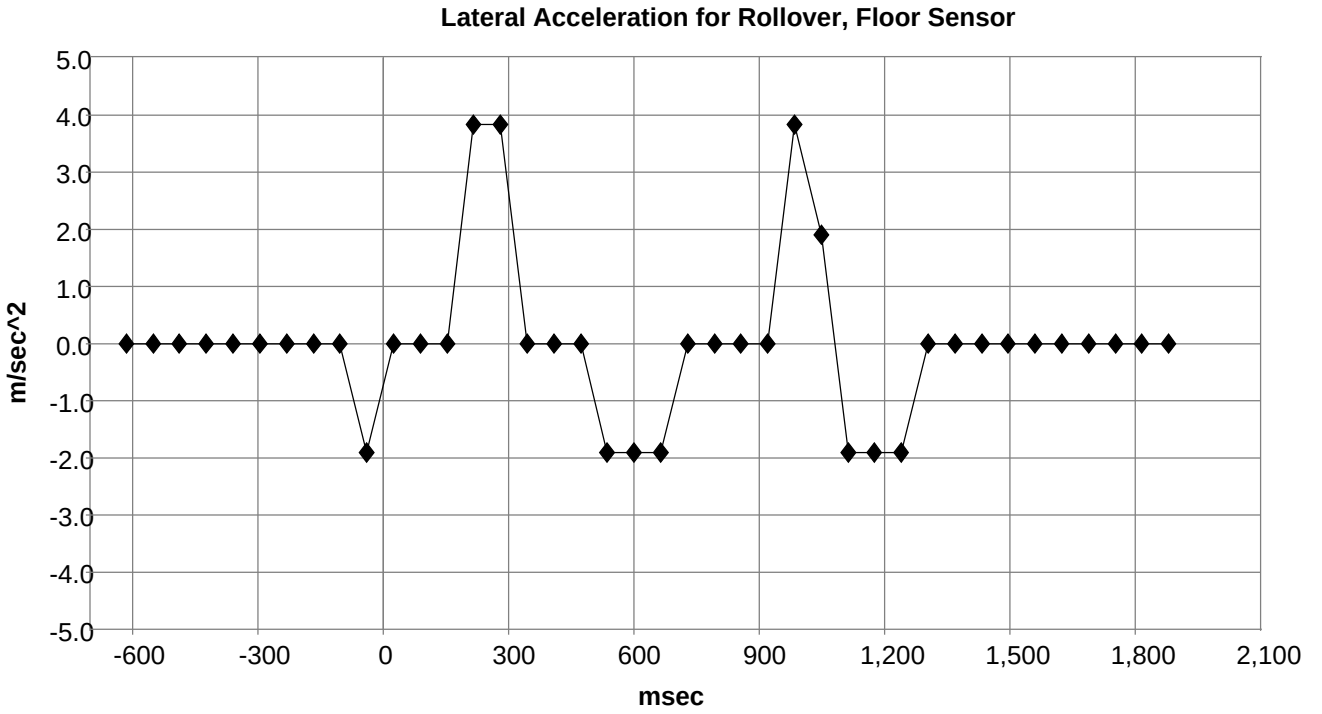
Rollover Crash Pulse (4th Prior Event, TRG 1 - table 1 of 2)

Recording Status, Time Series Data	Complete
Time from TRG to Next Sample (msec)	24
Roll Angle Peak (degrees)	-8.0
Roll Angle at the Time of TRG (degrees)	-3.9



Deployment Time Marker Key

1	Driver/Passenger CSA
2	Driver/Passenger Pretensioner



Deployment Time Marker Key

1	Driver/Passenger CSA
2	Driver/Passenger Pretensioner

Rollover Crash Pulse (4th Prior Event, TRG 1 - table 2 of 2)

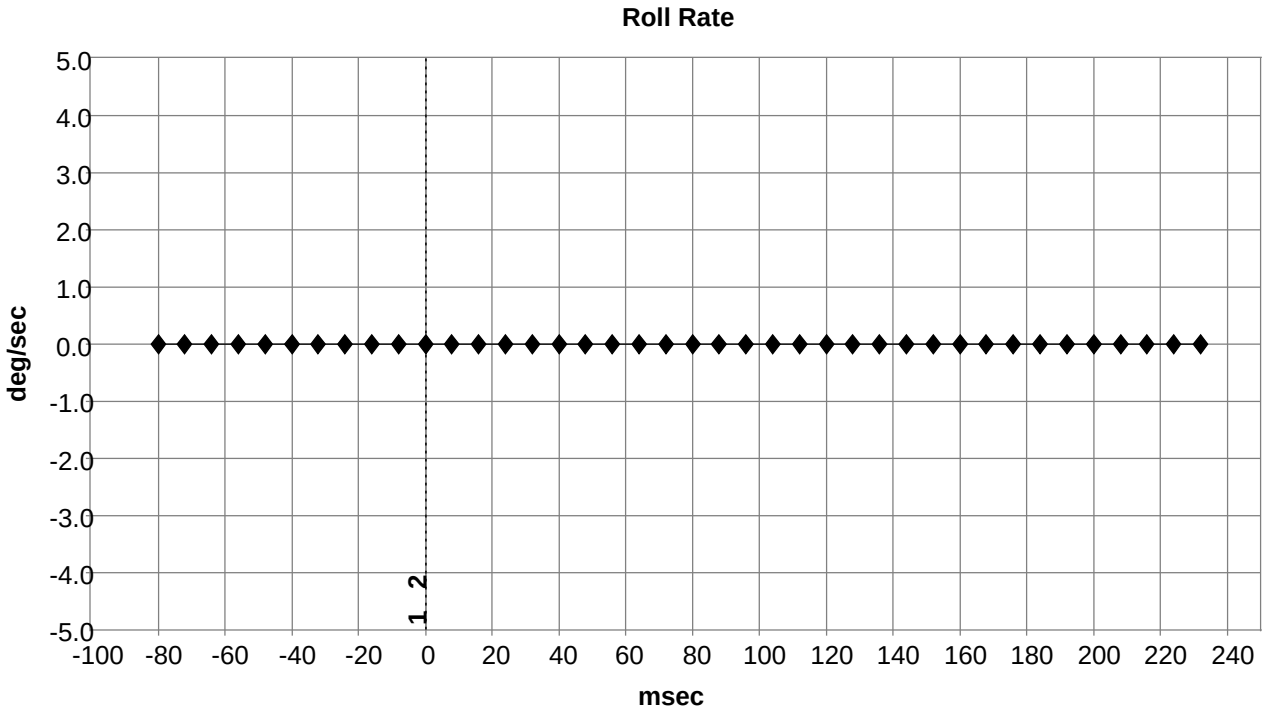
Time (msec)	Roll Rate (deg/sec)	Lateral Acceleration for Rollover, Floor Sensor (m/sec^2)
-616	0.0	0.0
-552	0.0	0.0
-488	0.0	0.0
-424	0.0	0.0
-360	0.0	0.0
-296	0.0	0.0
-232	0.0	0.0
-168	0.0	0.0
-104	0.0	0.0
-40	-1.6	-1.9
24	-37.5	0.0
88	-47.2	0.0
152	-16.3	0.0
216	4.9	3.8
280	6.5	3.8
344	8.1	0.0
408	16.3	0.0
472	19.5	0.0
536	9.8	-1.9
600	-1.6	-1.9
664	-8.1	-1.9
728	-6.5	0.0
792	-4.9	0.0
856	-3.3	0.0
920	11.4	0.0
984	34.2	3.8
1048	24.4	1.9
1112	14.7	-1.9
1176	11.4	-1.9
1240	-3.3	-1.9
1304	-16.3	0.0
1368	-14.7	0.0
1432	-13.0	0.0
1496	-8.1	0.0
1560	0.0	0.0
1624	8.1	0.0
1688	11.4	0.0
1752	9.8	0.0
1816	3.3	0.0
1880	0.0	0.0

System Status at Event (TRG Invalid #1)

Recording Status, Rollover Crash Info.	Incomplete
Crash Type	Rollover
TRG Count (times)	Invalid
Previous Crash Type	Front/Rear Crash
Time from Pre-Crash TRG (msec)	0
Linked Pre-Crash Page	0
Side Curtain Airbag Deployment, Time to Deploy (msec)	0
Pretensioner Deployment, Time to Fire, Driver (msec)	0
Pretensioner Deployment, Time to Fire, Front Passenger (msec)	0

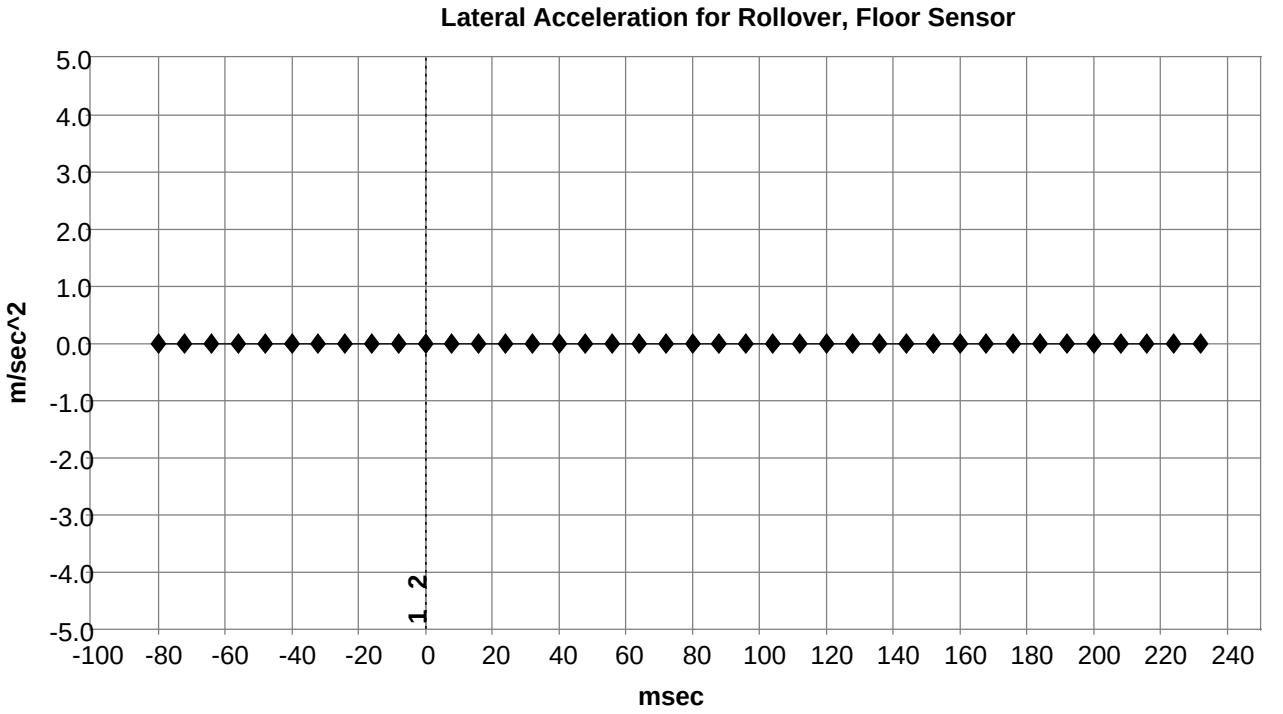
Rollover Crash Pulse (TRG Invalid #1 - table 1 of 2)

Recording Status, Time Series Data	Incomplete
Time from TRG to Next Sample (msec)	0
Roll Angle Peak (degrees)	0.0
Roll Angle at the Time of TRG (degrees)	0.0



Deployment Time Marker Key

1	Driver/Passenger CSA
2	Driver/Passenger Pretensioner



Deployment Time Marker Key

1	Driver/Passenger CSA
2	Driver/Passenger Pretensioner

Rollover Crash Pulse (TRG Invalid #1 - table 2 of 2)

Time (msec)	Roll Rate (deg/sec)	Lateral Acceleration for Rollover, Floor Sensor (m/sec^2)
-80	0.0	0.0
-72	0.0	0.0
-64	0.0	0.0
-56	0.0	0.0
-48	0.0	0.0
-40	0.0	0.0
-32	0.0	0.0
-24	0.0	0.0
-16	0.0	0.0
-8	0.0	0.0
0	0.0	0.0
8	0.0	0.0
16	0.0	0.0
24	0.0	0.0
32	0.0	0.0
40	0.0	0.0
48	0.0	0.0
56	0.0	0.0
64	0.0	0.0
72	0.0	0.0
80	0.0	0.0
88	0.0	0.0
96	0.0	0.0
104	0.0	0.0
112	0.0	0.0
120	0.0	0.0
128	0.0	0.0
136	0.0	0.0
144	0.0	0.0
152	0.0	0.0
160	0.0	0.0
168	0.0	0.0
176	0.0	0.0
184	0.0	0.0
192	0.0	0.0
200	0.0	0.0
208	0.0	0.0
216	0.0	0.0
224	0.0	0.0
232	0.0	0.0

DTCs Present at Time of Event (Unlinked, Page 0)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Airbag Warning Lamp ON Time Since DTC was Set (min)	0
Diagnostic Trouble Codes	None

Pre-Crash Data, 1 Sample (Unlinked, Page 0)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	250
TRG Count when Pre-crash TRG was Established (times)	1
Safety Belt Status, Driver	ON
Safety Belt Status, Front Passenger	ON
Occupant Size Classification, Front Passenger	AM50 (Not Child)
Frontal Airbag Suppression Switch Status, Front Passenger	SNA
RSCA Disable Switch	SNA
Seat Track Position Switch, Foremost, Status, Driver	No
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	4445

Pre-Crash Data, -5 to 0 seconds (Unlinked, Page 0)

Time (sec)	-4.75	-4.25	-3.75	-3.25	-2.75	-2.25	-1.75	-1.25	-0.75	-0.25	0 (TRG)
Vehicle Speed (MPH [km/h])	13 [21]	13 [21]	12.4 [20]	11.8 [19]	11.2 [18]	11.2 [18]	11.2 [18]	10.6 [17]	10.6 [17]	9.9 [16]	9.3 [15]
Accelerator Pedal, % Full (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Engine RPM (RPM)	1,000	1,000	900	900	900	900	900	900	800	800	800
Motor RPM (RPM)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Service Brake, ON/OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
Brake Oil Pressure (Mpa)	0.38	0.38	0.43	0.58	0.38	0.34	0.29	0.34	0.48	0.82	1.97
Longitudinal Acceleration , VSC Sensor (m/sec^2)	-0.431	-0.359	-0.646	-0.790	-0.574	-0.574	-0.359	-0.502	-0.646	-1.148	-4.522
Yaw Rate (deg/sec)	-9.27	-8.30	-7.32	-6.83	-6.83	-6.34	-6.34	-5.37	-5.37	-3.42	5.86
Steering Input (degrees)	-61.5	-55.5	-48.0	-49.5	-48.0	-48.0	-48.0	-42.0	-39.0	-25.5	-12.0
Shift Position	D	D	D	D	D	D	D	D	D	D	D
Sequential Shift Range	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
Cruise Control Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, PWR	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, ECO	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
Drive Mode, Sport	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Snow	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, EV	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

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 system.

Hexadecimal Data Has Been Removed To Prevent The Retrieval Of Personal Identifiable Information

Disclaimer of Liability

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

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